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# TRANSACTIONS

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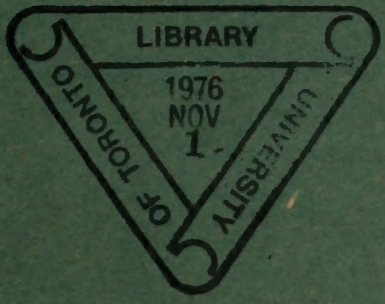


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VOLUME V. No. 8.

Proceedings of a Meeting of the Society on Friday, June 21st, 1912, SIR WILLIAM LEISHMAN, F.R.S., *President*, in the Chair.

# THE HUMAN TRYPANOSOMIASIS OF NYASALAND.

BY

MEREDITH SANDERSON, M.R.C.S.

## I.—HISTORICAL.

In view of the fact that *Glossina palpalis* does not occur in the Protectorate it was hoped that there was no danger of trypanosomiasis becoming endemic, and until recently such cases as were diagnosed were thought to have been imported from North-eastern Rhodesia, though in June, 1910, Dr. H. S. STANNUS[1] pointed out that in two of the cases the history suggested that infection had been contracted in the Protectorate, and postulated *G. fusca* (*brevipalpis* NEWST.), as the infecting agent.

The first case was found in the West Nyasa district by Dr. J. B. DAVEY, in October, 1908, whereupon investigations on a large scale were instituted, Drs. STANNUS and DAVEY being detailed to the northern districts, and the late Capt. HARDY, R.A.M.C., to those on the south-west shores of Lake Nyasa. These investigations were very thoroughly carried out and altogether some 60,000 natives were examined by gland palpation, blood-smears being made from sick persons. No cases were, however, found by this means.

In December of the same year Capt. HARDY was found to be infected, and it was said that in some way he must have inoculated himself from the patient under his charge; there was, however, not the slightest evidence to support this assumption. Latterly it has been suggested that he may have contracted the disease in the Congo, and was responsible for its introduction into this country. Personally, I am inclined to agree with the opinion of the ill-fated officer himself, who believed that he had become infected while investigating in the plains bordering Lake Nyasa.

During 1909 three further cases were diagnosed, one at the mission hospital at Kota-Kota, and the others in that at Blantyre; and in June, 1910, another at the Government hospital in Zomba.

At this time (1910) the writer was the only officer detailed for investigation work, and when, in August of that year, two cases were found in the mission hospital at Kasungu, near the Rhodesian border, and a third at the Mvera mission hospital in the Dowa district, he was recalled from North Nyasa to re-establish the segregation camp at Dowa, and to investigate in that district.

Shortly after arrival a European of the Dutch mission was seen and was found to be heavily infected with trypanosomiasis. From the history it was evident that the patient had become infected while shooting in the neighbourhood. This was the first certain intimation that previous cases had not necessarily been imported.

Investigations were immediately commenced, and during September, six cases were found in that part of the Dowa district near the lake. At the same time reports were received of a heavy death-rate in some villages, due to some disease not known to the natives, but which was suggestive of trypanosomiasis.

During the following fifteen months a total of 47 cases have been diagnosed from the same locality, exclusive of those who were regarded with suspicion, but in whom no diagnosis was made before death supervened.

A temporary camp was built at Mvera mission under the charge of Dr. W. A. MURRAY, to which cases were sent as found. A permanent camp has since been built on Ng'ani Hill, to which the patients were transferred in May, 1911.

## II.—METHODS OF INVESTIGATION.

When investigations were first commenced the following procedure was adopted:—Warning was sent to the headman of the village to be visited that all his people were required to be present for examination, and on arrival at the village the inhabitants were palpated for enlarged glands, any sick persons being examined. It was soon found, however, that only a percentage of the population was seen, and that the sick were least likely to be produced. A native capitao was then sent on ahead with instructions to find out if there were any sick in the village to be visited, and no warning was given of my approach. The natives had thus no time to remove their sick and a rigorous house-to-house search brought them to light. By these means the first cases were discovered. It was found that a large percentage of healthy natives had palpable glands in no way different from those of the infected persons, so that this method of choosing subjects for examination—gland palpation—was discontinued.

In view of the obstructive tactics adopted by the natives, I recommended in my first report that a census of this part of the district be made, and the scattered isolated communities concentrated into large villages. This was approved, and a special magistrate, Mr. A. H. Wyatt, was detailed for the duty. The census was ready for use in January, 1911, and has been found to be of great assistance, though very careful and continuous correction is necessary to keep it up to date, as its efficiency is dependent on absolute accuracy. Its moral effect on the natives, in assisting control, is not the least of its uses. A system of passes is a necessary adjunct to the census, and it is indispensable that it be scrupulously carried out.

Certain isolated villages which reported a heavy death-rate were removed to the hills, but no extensive scheme of depopulation was attempted. No villages were, however, left within the fly-belt proper.

A number of native capitaos were then taught how to make thick and thin blood-smears, and were detailed each to his own area, to patrol it regularly, and to report all cases of sickness and deaths. These patrols also take blood-smears from every sick person, without discrimination, and send them to head-quarters for examination. Accurate information is thus obtained as to the extent and severity of the endemic, and

numerous cases have been found by these means; such cases are, however, almost invariably in an advanced stage, and not infrequently die before admission into camp.

Every village is visited in person as often as possible, the roll called, and every man, woman and child inspected. Fresh coverslip preparations are made from every person who looks ill, or who has previously been reported as having been ill; any native having symptoms regarded as suspicious is kept under observation till a diagnosis is made.

### III.—EPIDEMIOLOGY.

It would seem that more natives become infected during the rains (November to March), and the weeks immediately preceding their breaking, than during the dry season. This may be explained by the fact that the natives commence working in their gardens in October, and as this necessitates clearing the bush, they would be more exposed to the bites of fly during these months than at any other time of the year. On the other hand the infected area is more or less flooded during the rains, and this, by lowering their resistance, may render the inhabitants more liable to infection, or, after infection, may accelerate the course of the disease. Certainly a larger number of deaths has occurred from all causes during these months.

It is of interest to note that of the 47 cases diagnosed in this locality, 25 or 53·2 per cent. were men, 18 or 38·3 per cent. were women, and 4 or 8·5 per cent. were boys. No girls have been found to be infected. It may be mentioned in this connection that among the natives, the men do all the work of clearing the bush in making a new garden, both sexes doing the hoeing, while the women alone are concerned in the fetching and carrying of water, firewood, etc.

In view of the fact that all cases found were either living in country infested with *G. morsitans*, or were proved to have recently visited such country, and, further, that the number of infected persons and of deaths in any village was directly proportionate to the amount of fly in the immediate neighbourhood, it has been assumed for the purposes of administration that this species is the definitive host of the disease. Recent researches by Taute[2] in Tanganyika, and by Kinghorn[3] in Rhodesia, tend to show that this assumption is correct. Considerable work, however, yet remains to be done, and though everything indicates

that *G. morsitans* is the vector, it is still possible that other arthropods may also be implicated.

As already mentioned, it was suggested by STANNUS[1] that *G. brevipalpis* might be the vector, and it is not improbable that this species will be found to be capable of acting as such, but in view of its scarcity and of its retiring habits it can be only of secondary importance.

The population of the proclaimed area (*i.e.*, over 6 years of age) is 15,426, and of these ·3 per cent. have during the past 15 months been proved to have died from trypanosomiasis. This area, however, includes many villages situated some miles from the fly-belt. The villages in and near the area regarded as the endemic centre have a total of 2,932 adult inhabitants, and of these 1·26 per cent. have been diagnosed as infected. A few villages situated on the border of the fly-belt show an adult death-rate varying from 100 to 150 per 1,000, and 41·6 per cent. of these deaths are known to have been due to this disease, while a further 19 per cent. were regarded as suspicious. The villages removed from the area in 1910, which reported a still heavier death-rate, are not included in these figures.*

It is evident from the above figures that the epidemic is confined to a somewhat limited area as far as this district in concerned, though, as by far the greater proportion of the extensive areas infested by *G. morsitans* remains to be investigated, nothing is yet known as to the extent of trypanosomiasis in the Protectorate as a whole.

It yet remains to be seen whether the slight mortality evidenced by the statistics quoted above can be regarded as due to recent importation of the disease. It is possible that such sporadic infections are rather evidence that *G. morsitans* is the definite host of the disease, as the migratory habits of this fly would result in an infected area, as contrasted with an infected spot where *G. palpalis* is concerned.

Moreover, it is now known that only a small percentage of *G. palpalis* is capable of transmitting trypanosomiasis, and it is a fair assumption that the same holds good for *morsitans*. Postulating *G. morsitans* as the vector, then, it is probable that no such rapid annihilation of communities as occurred in Uganda, for instance, will result here.

The natives do not differentiate trypanosomiasis from other wasting diseases, and seeing that the greater part of the investigation work

* See also Tables, pages 314, 315 and 316.

carried out in previous years was done in areas not infested by *G. morsitans*, it is not impossible that the disease has existed in the Protectorate for years unsuspected. The area now known to be infected must be kept under observation for some years, and investigations extended to all parts of the Protectorate where *morsitans* occurs, before there are sufficient data to warrant any assumption that trypanosomiasis is necessarily of recent introduction.

## IV.—ÆTIOLOGY.

The trypanosome is morphologically indistinguishable from *T. gambiense*; dimorphism is marked. STANNUS[4] has obtained by sub-inoculation, trypanosomes resembling the *T. rhodesiense* of STEPHENS and FANTHAM, in that the macronucleus was posterior to (*i.e.*, nearer to the non-flagellar end than) the micronucleus, and considering the similarity of conditions in North-eastern Rhodesia, and the proximity of that country,* it may be regarded as certain that the parasite is the same.

The parasite is further differentiated from *T. gambiense* by the numbers in which it may occur in the peripheral circulation. In the slide taken from Mr. R., from which the diagnosis was made, as many as 10 trypanosomes were counted in a single field (1/12 obj.), and of one of the Rhodesian cases, also a European, it is said, "Trypanosomes were present in considerable numbers, up to 8 to 10 per field."[5]

The numbers vary a great deal in natives, but in no case have they been found in such numbers as in these Europeans. Comparison is, however, difficult, as native cases are rarely seen in the early stages.

## V.—INCUBATION PERIOD.

In only one native case has it been possible to obtain any information as to the date of infection, even approximately. In this instance the patient left a village on the lake-shore to visit an infected locality, and was taken ill three weeks after her arrival, giving a maximum period of incubation of twenty-one days.

On the other hand there have been three infections of Europeans in whom the history was more definite. The first of these, Mr. R., was noticed to be unwell—"quiet and not himself"—four days after having

* The Rhodesian fly-belt extends into Nyasaland and in one locality is separated from the lake-shore belt of that Protectorate by only about 12 to 15 miles. (See Map II.)

been severely bitten by tsetse; three days later his temperature was found to be 102·5°. Another case, infected in North-eastern Rhodesia, had a severe chill—the initial symptom—about a fortnight after having been bitten by the fly. In the third instance the initial fever seems to have been developed some seven days after the probable date of infection, though as in the first mentioned case, the patient seemed to feel ill some two or three days earlier.[6] It may be said, then, that the incubation period in Europeans is from seven to fourteen days; possibly it is rather longer in natives, but more evidence is required.

## VI.—DURATION.

The total duration of the disease from infection to death is difficult to ascertain owing to the impossibility of getting reliable information from natives. At the outset, however, it was evident that the course of the disease was much more rapid than is usual in sleeping sickness. In one instance a native left his home in the hills to visit a relative in an infected village, and was taken ill soon after his arrival. He was dead (of trypanosomiasis) in less than four months. There was no evidence of any intercurrent disease. In this case the date of infection was ascertained by comparison with other events of known date. No treatment had been given.

On the other hand one case was under treatment at the camp for nine months, and died a month after its cessation. The history showed that she had been infected some two or three months before admission, giving a total duration of at least twelve months.

Three cases in which it is difficult to doubt the diagnosis have apparently recovered. One of these has now been under observation for fifteen months, another for thirteen months, and the third seven months. The first two were under treatment for a time, the last has had none. The first case found in the Protectorate in 1908, also, is alive and has apparently recovered.

## VII.—SYMPTOMS.

(1) *The initial fever.*—Few details are available, save in the European cases. In each of these there was considerable local reaction caused by *G. morsitans*—presumably the infecting agent—in each instance in the sub-occipital region. In one case, Mr. R., it was

described to me by a companion of the patient as a "lump about the size of a shilling, rather light in colour, and surrounded by a dark purple ring." Pain at the site was complained of two days after he had been bitten by tsetse,—undoubtedly *G. morsitans*—and the lump was first noticed four days later. When seen fourteen days after the exposure to the fly, there was considerable œdema of the face and neck, but no trace of the lump remained.

In the second instance, Dr. G., infected in North-eastern Rhodesia, "a bite (by *morsitans*) received in the neck became greatly inflamed, and subsequently a black scab ¾ in. in diameter formed at this site."[7]

The third patient, Mr. F., complained of pain in the neck, "and his native servants noticed three swellings on the side of his face, and one on the back of the neck, apparently due to insect bites."[7]

In natives, a history of a similar reaction was obtained in two instances, both cases of Dr. PRENTICE, of the Kasungu mission, but no similar history has been elicited from any of the natives infected in the Dowa district, though this has little significance.

It has been said that such local reaction to the bite of the fly may be due to bacterial agency. Only very transient swelling and irritation are, however, normally caused by the bite of *G. morsitans*, so that it is probable that the more severe reaction occurring in persons subsequently found to be infected, is due to the introduction of the virus of trypanosomiasis. The site of the inflammation, in all cases on the back of the neck, is explained by the fact that this is the usual part attacked by the fly when the subject is clothed. Unclothed natives, on the other hand, are usually attacked on the back or shoulders, and any local reaction would be considered as an ordinary boil and so disregarded and forgotten.

The local symptoms above described are accompanied by a general *malaise*, probably associated with a rising temperature. The acute manifestations are heralded by a sharp attack of pyrexia, sometimes accompanied by rigor, and the usual concomitants—headache, pains in the back and limbs, and nausea. The patient is only semi-conscious and there may be delirium. Diarrhœa occurs in some cases, but in others there is obstinate constipation. The temperature at first shews only slight remissions, and ranges from 103° to 104·5°. In one (untreated) case, Dr. G., the temperature became more irregular from the fifth day,

and soon showed intermissions. Œdema of the feet and legs developed on the twentieth day and "considerable deep-seated pain was complained of . . . . there was much pain on micturition, and twitching of the fingers during sleep. . . . Latterly some diminution of sensation in the extremities was complained of."[9] Unfortunately the patient at this stage developed pneumonia, which proved fatal.

In the case of Mr. R. the temperature was 102·5° on the seventh day after infection and rose gradually during the following week (to 104·2°). The patient was seen on the tenth day after the onset of the pyrexia; he was then "only semi-conscious; breathing stertorous. The neck was acutely inflamed, tender and indurated; glands not palpable. Tonsils and fauces swollen and inflamed, and covered with sloughy mucus. Pulse 120, regular, but feeble and of low tension. Temperature, a.m., 102°. Parasites very numerous (10 in one field). Atoxyl, grs. VI., injected. During the day the temperature rose steadily, reaching 105° at 6 p.m. At midnight the patient was greatly distressed, and the temperature is said to have been over 108° in the axilla. Shortly afterwards profuse sweating set in and the temperature fell to normal." When seen the next day the patient was very weak but conscious. The temperature was 99°. Parasites were still present in the peripheral blood, but the numbers were greatly diminished. The injection of atoxyl was repeated. The following day no parasites were found in two slides, and they remained absent for five days. Thereafter they reappeared and were constantly present, though in varying numbers, throughout the course of the disease. On the thirteenth day the improvement was very marked, the patient being cheerful and all objective symptoms having cleared up.

The above notes, made at the time by the writer, are reproduced as illustrating the severity of the infection, and the exceptionally sharp reaction to atoxyl.

A history of recurring attacks of headache and pain in back and limbs ("litsipa") is frequently obtained from native cases, and it is probable that the onset of the disease is characterised by an initial pyrexial attack of more or less severity in all cases. Many native patients mention œdema of the feet as the earliest symptom, and this was seen in one. Allusion has already been made to the occurrence of œdema in the European case, Dr. G., on the twentieth day of the disease.

It is a very constant symptom later, but it would seem that it not uncommonl yrecurs from time to time throughout the course of the disease.

(2). Following the initial fever there is a stage of periodical attacks of fever, which recur in some cases with marked regularity ; a corresponding increase in the number of parasites has been observed, though no exact enumerative methods have been attempted. This recurring fever is associated with a certain amount of emaciation and weakness, but frequently the condition of the patient improves under treatment. Severe pain in the legs is an almost constant complaint, and often seems to cause the patient more distress than any other symptom ; the pain is often said to be worse at night.

In the European case, Mr. R., the periodicity of the fever was very marked. At first there was a 3 days' period of pyrexia followed by 4 days more or less complete intermission ; later, in the third month, the apyrexial period extended to 5 days, and the 3 days' rise in temperature was less.

This stage may continue for some months under treatment ; the patient is sometimes able to work, the appetite is good, and there are frequently no objective symptoms. Sooner or later, however, the patient begins to lose strength, emaciation rapidly increases, and there is marked anæmia. The temperature becomes remittent and the periodicity is lost; later it is very irregular, though it does not range high, rarely above 101°—in some cases it does not exceed 100°. After a few days the patient becomes too weak to walk and does not leave his bed ; he loses interest in his surroundings, and refuses any but the most easily swallowed food. Obstinate diarrhœa frequently sets in and helps to undermine the patient's strength. After some two to three weeks the weakness and emaciation are extreme, the patient becomes unconscious and cannot be roused. Food is no longer taken. Occasionally there is muttering delirium, but more often the patient is completely comatose. In from two to three days the patient is dead. In some cases there is a rise of temperature (103°) immediately before death, but there is never hyperpyrexia. In one such case the patient was working (voluntarily) up to within a month of death, and, though somewhat thin, he had no objective symptoms. Parasites were, however, always plentiful in the blood. In this case, as in many others, no trypanosomes could be found in the blood when the coma preceding death had set in.

In other cases, usually those that have been diagnosed early and have been under treatment for some months, the symptoms of the last stage are similar to the above, but the course is longer. Even in these there is an absence of the clinical picture of sleeping sickness. The symptoms suggested rather a toxœmia. Often, though apparently asleep, he is conscious of one's entrance into the hut and opens his eyes directly when spoken to, and looks at his interrogator when replying. His manner, however, is frequently dull and apathetic, and cerebration is slow. He will not fall asleep during one's visit. He will take his food normally except when prevented from doing so by weakness.

In such cases the emaciation becomes so extreme that it is impossible to prevent the formation of bedsores. A few days before the end the lips become swollen and ulcerated; incontinence occasionally occurs, but it is not common. The onset of coma is invariably of fatal significance, and death ensues in from two to three days.

(3) *Glands.**—Of the 47 cases diagnosed, 12 died before admission and were not seen. In the other cases the posterior cervical glands were affected at some period during the time that they were under observation, as follows:—

| | | | | |
|---|---|---|---|---|
| Of 35 cases | 4 or 11·4 | per cent. | had glands classed as | +. |
| | 7 ,, 20·0 | ,, | ,, ,, | + −. |
| | 10 ,, 28·5 | ,, | ,, ,, | + − −. |
| | 14 ,, 40·0 | ,, | no palpable glands. | |

Of the 4 cases having + glands, one was a European and 3 were natives. In the first, Mr. R., the adenitis developed in the fifth week, both sides being simultaneously affected. The enlargement was transitory, but recurred several times during the following three weeks. A month after the initial attack no trace of enlargement remained, and there was no further recurrence. In the second case the patient dated his illness from the commencement of pain in the neck, four days before he was seen; in this case also the adenitis was bilateral. It was very transient and did not recur; subsequently only one gland, classed as + −, remained enlarged. The other two instances have occurred recently; in both cases several glands were enlarged.

* The following classification for degree of enlargement is used as being sufficiently exact for practical purposes:—

+ − − = Small shotty glands; unpuncturable.
+ − = Not immediately evident, but puncturable.
+ = Obviously enlarged and easily puncturable.

In view of the transitory nature of the enlargement, it is evident that under different circumstances at least one of these cases might have been classed as having + - enlargement, and another as having no palpable glands. *Per contra*, it is probable that at least some of the other cases would have been found to have + glands if they had been seen earlier. This symptom is, however, usually noticed by natives, so that a history thereof should be obtainable. No history, either of pain in the neck or of a "lump" has been elicited from patients or their relatives.

With regard to + - glands, it will be seen that for every patient having this degree of enlargement, there were two who had no palpable glands. In healthy natives above the age of six years, 6·4 per cent. were found to have + - glands without obvious cause. Since ·3 per cent. of the population was found to be infected, 6·4 per cent. had + - glands, and 20 per cent. of those infected had similar enlargement, then only ·93 per cent. of natives having + - glands were found to be infected.

It should be noted that no difference has been detected between the + - glands of infected persons and those of healthy natives. The glands are usually single, freely movable, and, though not hard, are firm and not of the typical consistency of those classed as +. A chain of such glands was noted in one patient.

It is of interest to note that one man who was found to have a + - gland in September, 1910, which was punctured, the blood also being examined, both with negative results, was found to be infected in September, 1911. He was a mission teacher, and had been working up to within four months of his death at the end of September. As no other similar case has been met with this was probably merely coincidence, and I do not consider that the earlier enlargement was due to trypanosomiasis.

Enlargement of the posterior cervical glands was noted in three of the earlier cases, but I do not know how they were classified.

With regard to glands other than those of the posterior cervical group, no degree of enlargement greater than + - - has been noted in any native without obvious cause. The inguinal glands are almost invariably enlarged in all natives.

(4) *Skin.*—A circinate erythema occurred in the eleventh week in one case, Mr. R.; the back and chest were affected. The rash cleared up in three days, and reappeared for a similar period some two weeks later.

In one of the earlier cases a "papular rash" is recorded. A history of a rash "like measles" was obtained in two of my cases. It was regarded by the patients as the initial symptom. With the exception of such conditions as pityriasis versicolor, common in all natives, no rashes have been seen in native cases.

The skin becomes very coarse, dry and scaly in many patients, but this is also seen in other conditions, especially in old people.

Œdema of the extremities is invariably present at some time during the course of the disease. The feet and anterior tibial regions are most commonly affected, but it also occurs in the hands, and, less often, in the face. As already mentioned, the œdema may occur soon after infection, and the degree varies considerably from time to time in individual cases. As a late symptom it is nearly constant. Some patients complain of severe pain in the feet, especially at night, preceding the development of the œdema; they sometimes state that the pain is markedly less as soon as the feet swell.

(5) *Nervous System.*—Tremor of the tongue and hands occurs in all cases in the last stages. In one case coarse tremors of the limbs, almost amounting to clonic spasm, were observed.

Epileptiform seizure was seen in one case. The patient was one of the few diagnosed early, and showed no objective symptoms. He had been treated with atoxyl, grs. VI., two days with 12 days' interval. No parasites were found after the commencement of treatment. Two months after admission, and five days after an injection of atoxyl, the temperature, which had been normal throughout, was found to be 99·40°, and the following day he had a "fit," resulting in paraplegia, accompanied by a temperature of 101°. The next day there was a second, slighter attack, epileptiform in character, during which he was unconscious for some five minutes; in the evening the temperature was sub-normal. He was quiet during the night, but died at dawn. The paraplegia persisted to the end. There was no family history of epilepsy.

Delirium, usually of a muttering type, occurs in some of the more rapid cases. In one case only did the patient become violent; the delirium was delusionary. The patient died on the third day.

No ocular symptoms, unconnected with treatment, have been noted.

Otitis media occurred in four cases. Deafness resulted in two of these, and also was noticed in two other cases in the later stages.

Loss of power in the legs is usual in the last stage, and seems to be the primary cause of the patient becoming bed-ridden. In one instance the onset was sudden, and was accompanied by coarse tremors affecting the whole body.

Taking into consideration the pain in the legs already alluded to, I am inclined to regard this symptom as being due to a multiple neuritis.

(6) *Circulatory System.*—Mitral insufficiency has been noted in six cases out of 32 admitted to the camp, —18·7 per cent. In one very advanced case the heart was dilated and the rhythm irregular; in the others compensation was maintained.

(7) *Respiratory System.*—Slight bronchitis has been observed in about a third of all cases, and pleurisy in two. These conditions are common among natives. A large proportion of advanced cases admitted give a history of "chifua," a term which includes any condition causing cough. I am not inclined to attach much importance to this.

I have not seen any of the fits of coughing with respiratory difficulty, reported by THIROUX,[10] as occurring in sleeping sickness.

(8) *Digestive System.*—A form of dysenteric diarrhœa has frequently attacked the patients in both the Mvera and the Ng'ani camps; it yielded readily to treatment in most cases, but was the immediate cause of death in some old patients. It should be mentioned that a similar affection is very common among the natives, especially at certain times of the year.

The spleen has been found to be enlarged in a number of the patients. It is difficult to say what the significance of such enlargement may be.

No marked enlargement of the liver has been noted.

## VIII.—TREATMENT.

(1) *Dioxydiamidoarsenobenzol ("Salvarsan.")*—This preparation has been tried in five cases; a single injection was given to each case, intramuscularly. One patient was given ·4 grm., two ·5 grm. and two ·6 grm. A neutral suspension of the drug with NaHO in distilled water was used, half being injected into each buttock. Some difficulty was experienced owing to the needle becoming blocked, as the only one available had too fine a bore. Especially was this the case when the injection was interrupted from any cause—such as movement of the patient. Very careful clearing of the bore of the needle was necessary after each injection.

Local pain, in some instances referred to the feet, was complained of by all the subjects, but in no case did it seem severe. Some deep-seated brawny infiltration resulted at the site of injection in two cases, one of whom had ·4 grm. and the other ·6 grm. There was no evidence of abscess.

Of these five cases, one died 14 days, and another 21 days after injection; all were dead within two months. Not one showed even temporary improvement. In two instances no parasites were found after injection, but they had always been scarce in one, and the patient was the first to succumb; in the other the disappearance was only temporary (5 days) and was possibly only coincidence.

It should be added that all these cases were advanced, and were considered as hopeless. Possibly the drug may be more successful in more favourable subjects.

(2) *Atoxyl.*—This drug has not been tried in combination with others, except with hyd. perchlor., but its use singly has been discontinued owing to the onset of amblyopia in several of the cases, when continued for any length of time. Attempts were made to obviate this by discontinuing the drug for a time and resuming after an interval. One case relapsed soon after the injections were stopped, and died, further treatment being refused. Another complained of dimness of vision when a single dose, ·6 grm., had been given after an interval of two months.

The methods of administration tried are as follows :—

(1) Atoxyl, ·4 grm. or soamin, grs. X. every 13th and 14th days.
(2) Same as (1) plus hyd. perchlor. gr. $\frac{1}{3}$ on 7th day.
(3) Atoxyl, ·6 grm. once a week.
(4) Soamin, grs. XV. every 14th day.

Of these methods, No. 1 was the most successful in prolonging life; two cases survived more than ten months after admission, and one eight months, but all three became partially blind. Two others showed temporary improvement, one of them at the expense of the sight.

There seems to be little to choose between the other methods tried. In many instances treatment had perforce to be discontinued, owing to the dislike of the patients to the intramuscular injection.

(3) *Soamin.*—This was not found to have any advantage over atoxyl, with which it was interchanged in most cases. In the one case in which

it was persisted in alone, the eyes were not affected; seven doses of 15 grs. were given. The patient improved considerably for some two months, but relapsed and died. The parasites persisted throughout.

Reference to Table I. will show that :—

In class A there have been three apparent recoveries—two of them without treatment, the diagnosis not having been confirmed—and two deaths.

In class B several patients have been benefited temporarily by treatment, but there was no lasting improvement in any—all relapsed and were dead within a year.

In class C not one case was benefited in the slightest degree by any form of treatment.

## IX.—DIAGNOSIS.

It will be seen from the symptoms above described that this form of trypanosomiasis, broadly speaking, differs from that transmitted by *G. palpalis* only in severity and rapidity of course, due to the virulence of the strain. It is, however, just these characteristics which make the diagnosis difficult. In individual cases repeated blood examinations, inoculation of susceptible animals, etc., may be employed, but in dealing with large numbers of natives inhabiting an infected area, these can only be used to confirm or disprove a tentative diagnosis from physical signs. The course of this disease is so rapid, and the physical signs are so fleeting and irregular in the early stages, that as a rule there are no indications by means of which subjects may be chosen for the more exact methods of diagnosis, until the emaciation and weakness of the last stages have developed.

The gland palpation method has been tried from time to time, but no cases have been found by this means. In one instance a village was visited and all the inhabitants palpated for enlarged cervical glands. A month later two of them were found to be infected, one being classified as B, and the other C. There was no doubt that both had been seen on the first visit.

It was hoped that auto-agglutination would be of use as a means of diagnosis, but though the blood shows this phenomenon in the majority of infected persons, it varies considerably in degree, and has been altogether absent in one or two cases. On the other hand it has been

observed in persons in whom repeated examinations have failed to find trypanosomes, and who have subsequently shown no signs of illness.

Marked leucocytosis occurs in most cases, the large mononuclear elements being chiefly affected, but as a rule it is not in any way marked till death is imminent.

## X.—MORBID ANATOMY.

One of the earlier cases (No. 9) died in Zomba and a post-mortem examination was made by Dr. STANNUS, but revealed little.[11] No autopsy has been performed at the camp in deference to native superstitions, as it was feared to make segregation even more dreaded.

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2. Zeitschrift für Hygiene und Infectionskrankgeiten. 1911, Oktober. lxix. Heft 3. pp. 553–558.
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4. Proceedings of the Royal Society. 1911. August 18. B. 570. pp. 156–160.
5. Nyasaland Sleeping Sickness Diary. Part XIII. pp. 10–14 (from notes by Mr. JOLLYMAN, N.E. Rhodesia.)
6. *Ibid.*
7. *Ibid.*
8. *Ibid.*
9. *Ibid.*
10. La maladie du sommeil et les Trypanosomiasis animales au Senegal. 1911. Paris Lib. Baillière et fils.
11. Nyasaland Sleeping Sickness Diary. Part XII. p. 5.

## TABLE I.

### Treatment.

| No. of Case. | Date of Admission. | Stage of Disease.* | Method of Treatment.** | Date of Death. | Remarks. |
|---|---|---|---|---|---|
| 11 | 8/8/10 | C | Nil. | 14/9/10 | |
| 12 | 31/8/10 | B | (see note***). | 5/6/11 | Returned to S. Africa, Jan.'11. |
| 13 | 5/9/10 | C | Nil. | 8/9/10 | |
| 14 | 10/9/10 | C | 1. | 28/10/10 | No improvement. |
| 16 | 13/10/10 | C | Nil. | 13/10/10 | |
| 18 | 16/10/10 | A | 1. | — | No symptoms after 2½ months' treatment. Treatment continued 6 months. No relapse. |
| 19 | 16/10/10 | C | 1. | 28/10/10 | No improvement. |
| 20 | 13/10/10 | B | 1 (6 months). | 8/8/11 | Amblyopia. Salvarsan given 25/7/11. |
| 21 | 15/11/10 | B | 2, 3. | 1/4/11 | Temporary improvement for 3 months. |
| 23 | 3/12/10 | B | 1 (5 months). | 20/7/11 | Partially blind. |
| 24 | 23/12/10 | B | 1 (5 months). | 8/10/11 | ·6 grm. caused partial blindness after 2 months' interval. |
| 25 | 8/1/11 | A | 1. | 8/3/11 | Epileptiform attack, paraplegia. |
| 27 | 7/3/11 | C | 1. | 30/3/11 | No improvement. |
| 31 | 9/3/11 | B | 1, 3. | 19/6/11 | Partially blind. |
| 32 | 9/3/11 | B | 1. | 2/4/11 | Dysentery. |
| 34 | 14/3/11 | C | 1. | 8/4/11 | No improvement. Dysentery. |
| 35 | 10/3/11 | C | Nil. | 14/3/11 | |
| 36 | 17/3/11 | C | Nil. | 19/3/11 | |
| 37 | 23/3/11 | B | 3 (2 months), 4 (2 months), 5. | 12/9/11 | Great improvement, lasting 4½ months. Relapse. |
| 38 | 29/3/11 | B | 1 (3 months), inter. (4 months), 4. | 17/11/11 | Apparent recovery, 4 months. Tryps. returned. Relapse. |
| 39 | 4/4/11 | B | "Maningo" (1 month). | 27/6/11 | Rapid course. |
| 40 | 1/4/11 | B | Ditto, 2, 5. | 1/10/11 | No improvement at first. Improvement with (2). Relapse. |

TABLE I.—TREATMENT—continued.

| No. of Case. | Date of Admission. | Stage of Disease.* | Method of Treatment.** | Date of Death. | Remarks. |
|---|---|---|---|---|---|
| 44 | 8/5/11 | A | Nil. | — | Diagnosis unconfirmed. |
| 46 | 25/5/11 | — | Nil. | — | Ditto. |
| 49 | 28/5/11 | B | 4. | 30/10/11 | Temporary improvement. Relapse. |
| 51 | 28/6/11 | C | Nil. | 16/8/11 | Dysentery. |
| 52 | 9/7/11 | C | 5. | 20/8/11 | No improvement. |
| 53 | 18/7/11 | C | Nil. | 20/7/11 | |
| 57 | 13/10/11 | C | Nil. | 6/11/11 | |
| 58 | 5/12/11 | B | Nil. | 15/1/12 | |
| 60 | 9/12/11 | C | Nil. | 14/12/11 | |
| 61 | 16/12/11 | C | Nil. | 13/1/12 | |
| 62 | 28/12/11 | C | Nil. | — | |

*NOTE.—A = "cas en bon etat"; B = clinical signs present; C = advanced case.

**METHODS OF TREATMENT:—1. Atoxyl ·4 grm., or soamin grs. X, every 13th and 14th day.

2. Same as 1, plus hyd. perchlor. grn. 1/3, on 7th day.
3. Atoxyl, ·6 grm. once a week, or soamin grs. X.
4. Soamin grs. XV. every 14th day.
5. Salvarsan.

***CASE NO. 12.—First 5 weeks, atoxyl grs. 6, 2 successive days, 5 days' interval.
Second 5 weeks, atoxyl grs. 3, every 3rd and 4th day.
11th to 18th week, soamin grs. X., every 13th and 14th day, $HgCl_2$ on 7th days.
18th week to discharge, soamin grs. X., 2 successive days, interval of 5 days.

CASE NO. 22, though under treatment for a short time, is not included in the above table, as there is some doubt as to the diagnosis.

## TABLE II.

### Shewing Relation of Trypanosomiasis to G. morsitans.

I.—Villages within the Nyansato fly-belt, removed in 1910 to hills: 6 cases. All reported a heavy death-rate.

II.—Villages situated on the border of the Nyansato fly-belt, having gardens within it.

| | No. of Villages. | Population (over 6 years). | Deaths from all causes, 1911. | Per cent. | Cases of Trypo., 1911. | Per cent. |
|---|---|---|---|---|---|---|
| Villages in which cases of Tryp. have been found, 1910-12 ... | 5 | M. 202<br>F. 225<br>427 | M. 29<br>F. 20<br>49 | M. 14·3<br>F. 8·8<br>11·4 | M. 11<br>F. 3<br>14 | M. 5·4<br>F. 1·3<br>3·2 |
| Villages in which NO cases of Tryp. have been found, 1910-12 | — | — | — | — | — | — |
| Totals ... | 5 | 427 | 49 | or 11·4 | 14 | or 3·2 |

III.—Villages on the plains, in the vicinity of the fly.

| | | | | | | |
|---|---|---|---|---|---|---|
| Villages in which cases of Tryp. have been found, 1910-12 ... ... | 15 | M. 691<br>F. 780<br>1471 | M. 23<br>F. 25<br>48 | M. 3·3<br>F. 3·2<br>3·2 | M. 8<br>F. 7<br>15 | M. 1·15<br>F. 0·8<br>0·97 |
| Villages in which NO cases of Tryp. have been found, 1910-12 | 40 | M. 1189<br>F. 1900<br>3089 | M. 33<br>F. 46<br>79 | M. 2·7<br>F. 2·4<br>2·5 | —<br>—<br>— | —<br>—<br>— |
| Totals ... | 55 | M. 1880<br>F. 2680<br>4560 | M. 56<br>F. 71<br>127 | M. 2·9<br>F. 2·6<br>or 2·7 | M. 8<br>F. 7<br>15 | M. 0·47<br>F. 0·2<br>or 0·31 |

TABLE II.—SHEWING RELATION OF TRYPANOSOMIASIS TO G. MORSITANS—continued.

IV.—Villages in the foot-hills, little exposed to fly.

| | No. of Villages. | Population (over 6 years). | Deaths from all causes, 1911. | Per cent. | Cases of Trypo., 1911. | Per cent. |
|---|---|---|---|---|---|---|
| Villages in which cases of Tryp. have been found, 1910-12 ... ... | 3 | M. 188<br>F. 273<br>461 | M. 8<br>F. 8<br>16 | M. 4·2<br>F. 2·9<br>3·5 | M. 1<br>F. 1<br>2 | M. 0·53<br>F. 0·36<br>0·44 |
| Villages in which NO cases of Tryp. have been found, 1910-12 | 63 | M. 1634<br>F. 2462<br>4096 | M. 25<br>F. 24<br>49 | M. 1·5<br>F. 0·9<br>1·2 | —<br>—<br> | —<br>—<br> |
| TOTALS ... | 66 | M. 1822<br>F. 2735<br>4557 | M. 33<br>F. 32<br>65 | M. 1·8<br>F. 1·1<br>or 1·45 | M. 1<br>F. 1<br>2 | M. 0·05<br>F. 0·04<br>or 0·04 |

V.—Villages on the lake-shore, some having gardens in the vicinity of fly.

| | | | | | | |
|---|---|---|---|---|---|---|
| Villages in which cases of Tryp. have been found, 1910-12 ... ... | 4 | M. 134<br>F. 203<br>337 | M. 8<br>F. 4<br>12 | M. 5·9<br>F. 1·9<br>3·9 | M. 2<br>F. 1<br>3 | M. 1·4<br>F. 0·49<br>0·95 |
| Villages in which NO cases of Tryp. have been found, 1910-12 | 37 | M. 2191<br>F. 3354<br>5545 | M. 37<br>F. 55<br>92 | M. 1·6<br>F. 1·6<br>1·6 | —<br>—<br> | —<br>—<br> |
| TOTALS ... | 41 | M. 2325<br>F. 3557<br>5882 | M. 45<br>F. 59<br>104 | M. 1·9<br>F. 1·6<br>or 1·7 | M. 2<br>F. 1<br>3 | M. 0·08<br>F. 0·02<br>or 0·05 |

TABLE II.—SHEWING RELATION OF TRYPANOSOMIASIS TO G. MORSITANS—continued.

VI.—All villages in the proclaimed area.

| | No. of Villages. | Population (over 6 years). | Deaths from all causes, 1911. | Per cent. | Cases of Trypo., 1911. | Per cent. |
|---|---|---|---|---|---|---|
| Villages in which cases of Tryp. have been found, 1910-12 ... ... | 27 | M. 1215<br>F. 1481<br>2696 | M. 68<br>F. 57<br>125 | M. 5·5<br>F. 3·7<br>4·6 | M. 23<br>F. 12<br>35 | M. 1·8<br>F. 0·81<br>1·3 |
| Villages in which NO cases of Tryp. have been found, 1910-12 | 140 | M. 5014<br>F. 7716<br>12730 | M. 95<br>F. 125<br>220 | M. 1·8<br>F. 1·6<br>1·7 | —<br>—<br>— | —<br>—<br>— |
| GRAND TOTAL ... | 167 | M. 6229<br>F. 9197<br>15426 | M. 163<br>F. 182<br>345 | M. 2·6<br>F. 1·9<br>or 2·2 | M. 23<br>F. 12<br>35 | M. 0·36<br>F. 0·12<br>or 0·24 |

N.B.—(1) The population is that in January, 1911.

(2) The numbers of deaths, and of cases of Trypanosomiasis, are those which have occurred during the year 1911 only.

ANALYSIS OF TABLE.

(1). The percentage of deaths from trypanosomiasis varies in direct proportion to the distance from the fly.

(2). The percentage of deaths from all causes has a similar variation, but is greater than can be accounted for by the number of cases of trypanosomiasis actually diagnosed.

(3). The number of males diagnosed as infected is nearly twice that of females.

DEDUCTIONS.

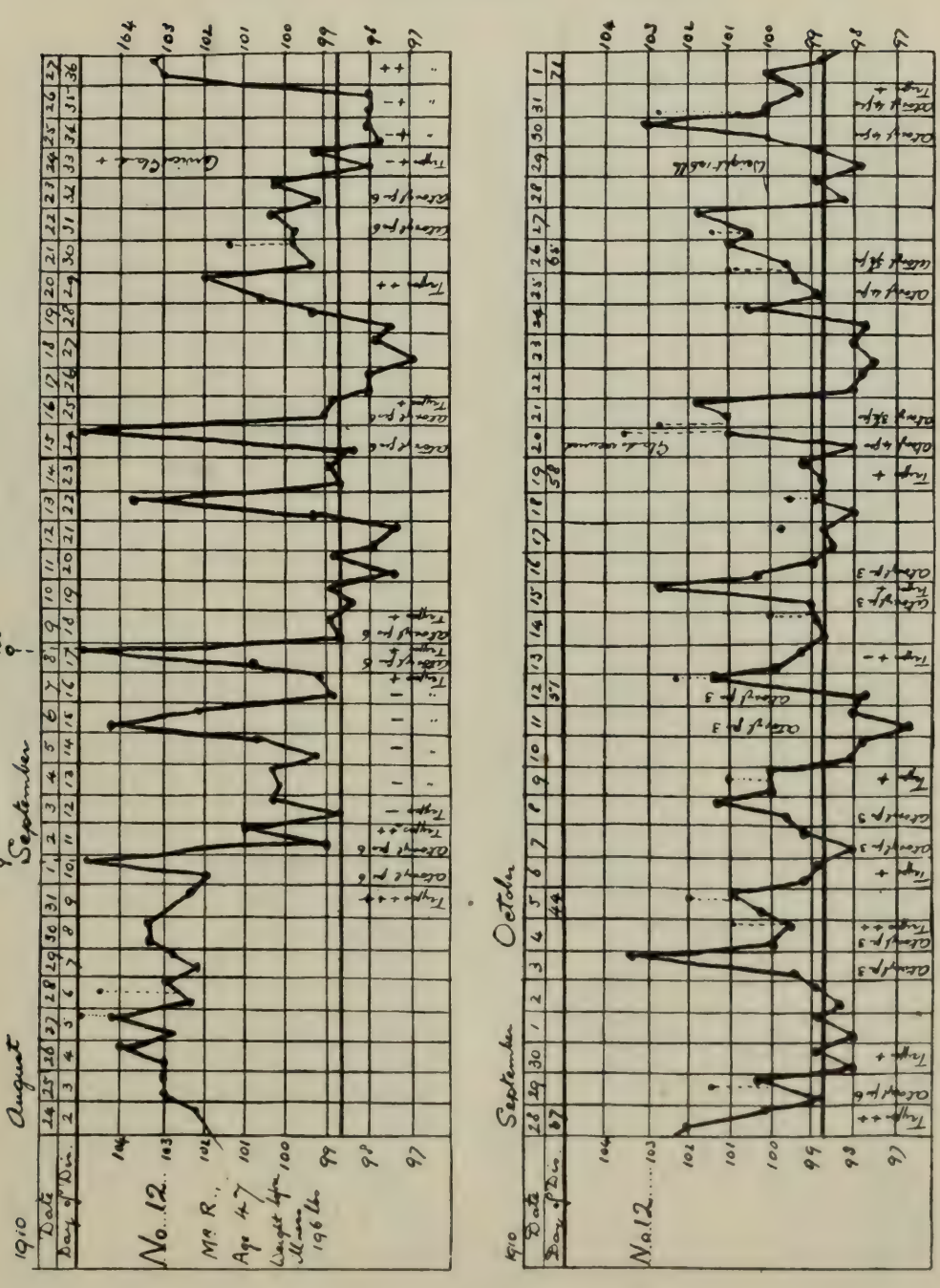
(1.) That *G. morsitans* is a definite host for this form of trypanosomiasis, and in this district, at least, is that most concerned in the spread of the disease.

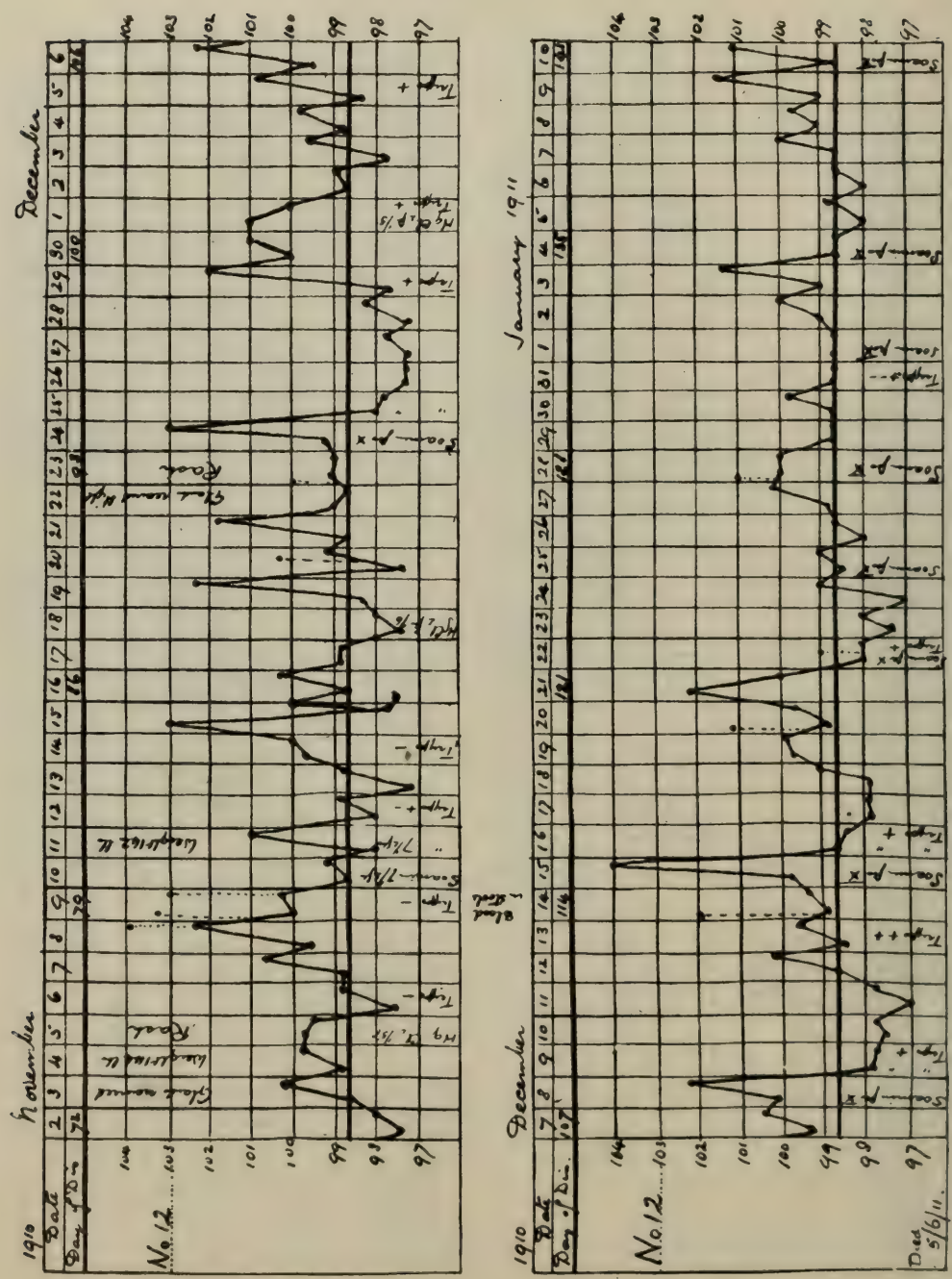
(2). That a larger number of persons are infected with, and die of, trypanosomiasis than is represented by the number of those actually diagnosed.

ADDITIONAL REMARKS.

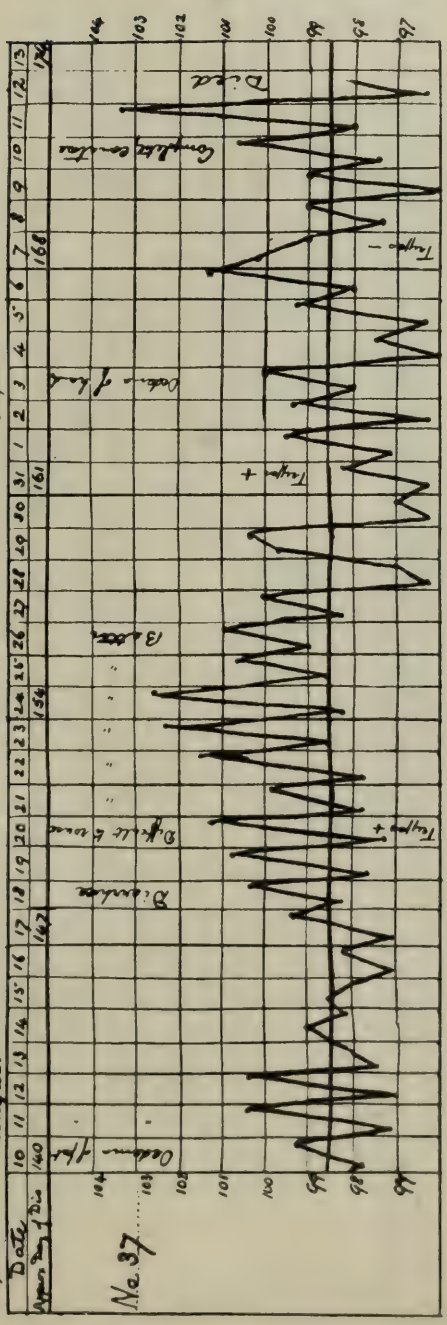
(1). Of the villages situated on the lake shore, those in the Northern part of the proclaimed area have a greater death-rate than those to the south. The same holds good for the villages situated in the foot-hills. This may, possibly, be explained by the fact that the proclaimed area is narrower to the north than to the south, and the fly approaches nearer to the foot-hills and to the lake here than elsewhere, except near Rifu where there are few villages.

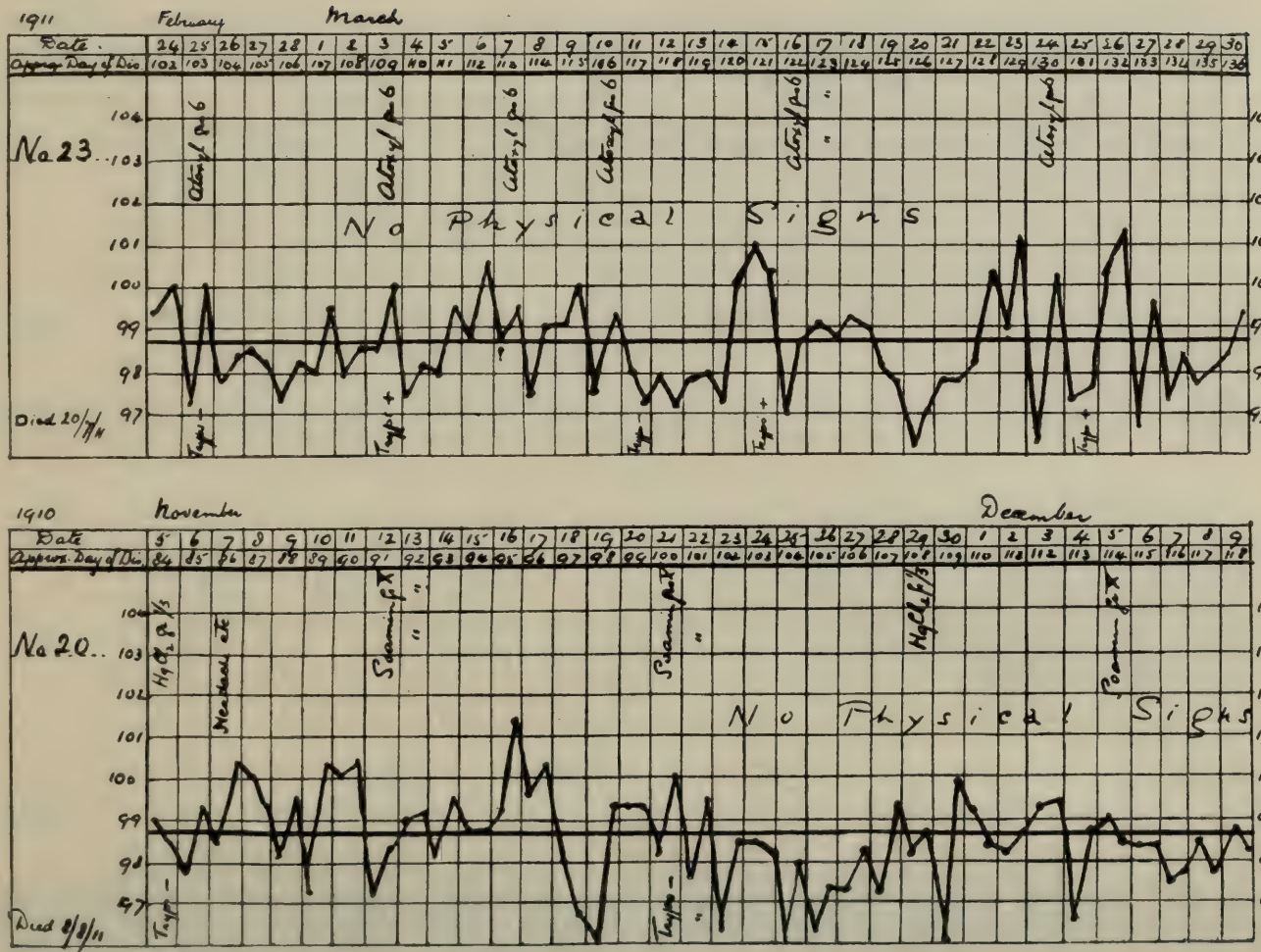
It is of interest to note, in this connection, that *G. brevipalpis* is found only to the north of the area, near the lake shore and up to a distance of about five miles therefrom, on two rivers. This species, however, has not been located in or near the foot-hills


1910
August
September
No. 12
Mr R.
Age 47
Weight 14st
Weight 196 lbs
Date
Day of Dis.
Temp
Obsvd P 6
Obsvd P 3
Obsvd A.M.
Obsvd A.P.
Obsvd Eve
Clear
Cloudy
Rain
1910
September
October
No. 12

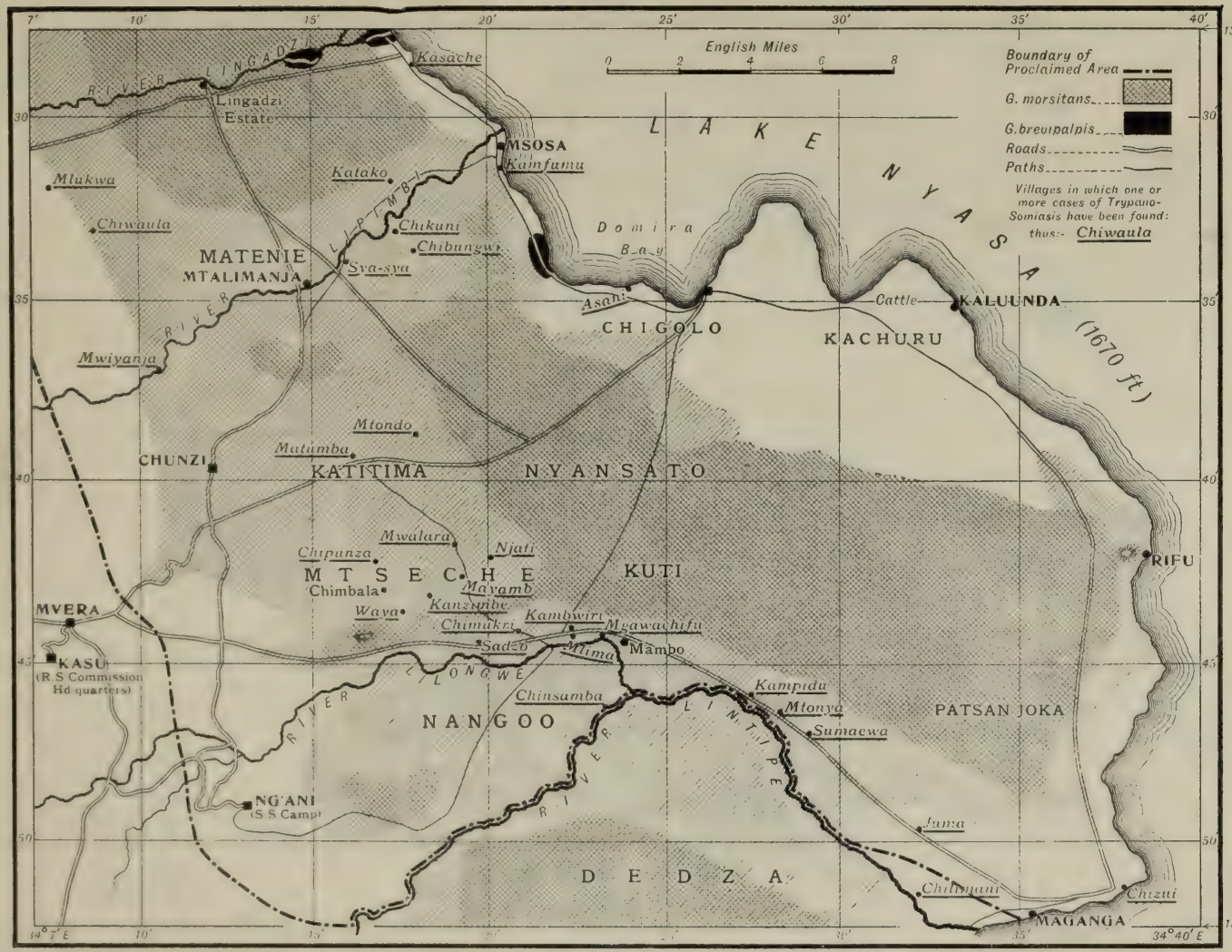



*The charts of Case No. 12 are reproduced by the courtesy of* Dr. W. A. MURRAY, *of Mvera, who was in charge of the case.*


1911
August
September
No. 37
Temp.
Pulse
Glands enlarged
Died
Oedema of legs
Diarrhœa
Blisters
Very typical
Trypanosomes
Blood-sucking flies
Temp. fell to 97 on Sept. 15th (Refused)

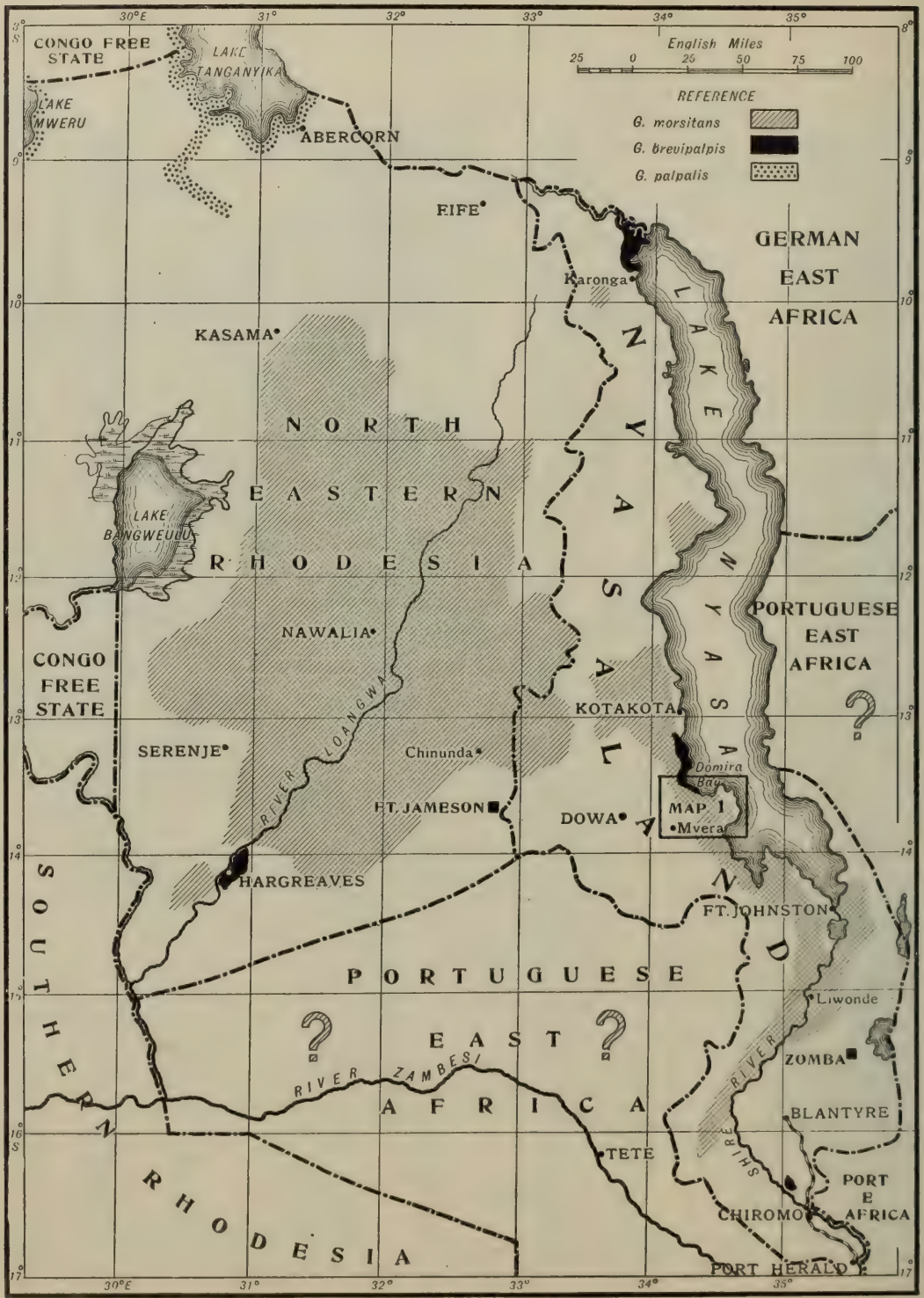

1911
February
March
Date
Approx. Day of Dis.
No. 23
No Physical Signs
Died 20/3/11
1910
November
December
No. 20
No Physical Signs
Died 8/8/11

*Part of the Dowa Sub-District, Nyasaland.*




*Map 1.*

*North Eastern Rhodesia and Nyasaland.*




*Map II.*

# THE PROPHYLAXIS OF TRYPANOSOMIASIS IN NYASALAND.

By MEREDITH SANDERSON, M.R.C.S.

In dealing with the prophylaxis of Trypanosomiasis, not only have we to consider the actual habitat of the fly acting as the definitive host, but also the extent of the surrounding area to which the fly is disseminated by its habit of following game and man. Whatever the species concerned, there can be no two opinions as to the necessity of the depopulation of the fly belt proper; the point is whether the "carrying area" should also be evacuated.

It may now be considered certain that *Glossina morsitans* is acting as the definitive host of trypanosomiasis in Nyasaland, and this owing to differences in habit, will greatly modify the prophylaxis of the disease. These differences are, in brief, that while *palpalis* haunts the neighbourhood of water, forms narrow belts, and is therefore more or less stationary in habit, *morsitans* avoids water, its belts cover large tracts of country, and, within them, it is essentially migratory in habit.

In effect, *palpalis* preys on the water-carriers, *morsitans* on the wood-cutters. Hence where *palpalis* is the definitive host, large numbers of cases occur in individual villages, and eventually all the inhabitants become infected. The migratory habits of *morsitans*, on the other hand, together with the lack of a constant place of resort, such as the watering-place of a village, give the fly comparatively little chance of fulfilling its rôle of vector, and therefore the cases tend to occur sporadically. Moreover, the Nyasaland form of the disease is so virulent that an infected person is too quickly incapacitated to multiply the number of infected fly by acting as carrier to any appreciable extent.

It is evident, then, that a large number of infected *morsitans* would be required even to approximate the havoc caused by a few infected *palpalis*, and, unless game is capable of acting as a carrier, the trypanosomiasis of Nyasaland is not likely to assume the proportions of an epidemic. Not only do the differences in habit of these two species affect the epidemiology of the disease, but they are of the greatest

importance when dealing with the prophylaxis. Thus, owing to the difference in width of their respective belts, the carrying area of *morsitans* is much more extensive than that of *palpalis*, so that in Nyasaland total depopulation becomes a very serious matter.

Now, the natural site for a village is near a constant water supply, such as a lake or river. Hence depopulation of the fly-belts only, means removal from the natural site in the case of *palpalis*, removal to it where *morsitans* is concerned. Partial depopulation of *palpalis* areas is therefore much more difficult than that of *morsitans* areas. On the other hand, the approach to a river or lake may be rendered comparatively free from *palpalis* by suitable clearings, whereas such limited clearings, are useless in dealing with *morsitans*. So that while the prophylaxis of trypanosomiasis in the case of *palpalis* areas must be one of two extremes—local clearings or total depopulation—a middle course seems to be best when dealing with a form of the disease carried by *morsitans*.

It is obvious that the extent of the carrying area and the number of fly therein are directly proportionate not only to the width of the belt proper, but also to the amount of traffic through it. Hence prophylaxis in Nyasaland means, in the first place, the removal of all villages from within the fly-belt and the closing of all roads that pass through it, and, secondly, the driving back of fly from the neighbourhood of villages.

The first requirement is the delineation of the belts proper. This can only be done by entering the belts from various points, and noting the spot where fly is first found in any numbers. This should be done fairly early in the day before much traffic has passed, but not so early that the fly has not yet become prevalent. It should be remembered that when the belt has once been entered the prevalence of the fly is no criterion of its true limits, owing to its habit of following for long distances. The observer should be in the van of his party. It is a good plan to have two natives immediately preceding him, as the fly almost invariably settles on the shoulders of their victims, and they will thus be readily seen. Several observations should be made on different occasions in each locality before they can be considered reliable.

The extent of the belt having been ascertained with more or less accuracy, the next proceeding is to remove all villages in any way isolated in the bush and to concentrate them on the rivers or lake shore.

As a rule this does not present any difficulties, as only small communities are, as a rule, found in such situations. It is all the more desirable that these should be brought together, as the inhabitants usually represent the more unruly sections of the tribe, who have left their own proper chief, and such concentration is a great step towards efficient control.

It will be found that although all villages have been removed from the fly-belt a large number of the settlements on the rivers will be only just outside it, and the inhabitants will be almost as much exposed to infection as in their former situation. It is obvious, then, that steps must be taken to drive the fly from the neighbourhood of such villages.

It cannot be too strongly insisted upon that mere clearings are useless in dealing with *morsitans*. It is essential that the land be put under cultivation, *e.g.*, cotton, ground-nuts, etc., in addition to maize. Now the native, left to himself, tends to make a series of isolated clearings when starting gardens in a new site. The natural result is that natives may have to pass through fly, both going to and returning from their gardens, are exposed to their bites while at work, and bring the fly back with them into the village. Thus not only are they themselves exposed to infection but they expose others also, and should there be a case of trypanosomiasis in the village they may cause the number of infected fly to be materially increased.

Not only are planted clearings required, therefore, but they should be contiguous and should surround the village. It would seem that *morsitans* does not return to country lying fallow, so that in course of time the extent of a belt might be greatly diminished, and wide swaths, more or less following the course of the rivers, be driven through it.

It is in the writer's experience that the carrying area of *morsitans* can be very strikingly decreased by the closing of roads through the belt. Obviously this may not always be feasible, though in some instances the route may be deflected so as to pass through the cleared and planted country along the rivers. It must be remembered that, though the risk is comparatively slight, any person travelling through a *morsitans* area is exposed to infection, and that this risk is directly proportionate to the amount of traffic on the road. Main routes are thus more dangerous than others. It is by these means that infection will infallibly spread south, though the virulence of the Nyasaland form of the disease will probably tend to retard such spread. Owing to the difficulty in diagnosis,

on the other hand, it will not be easy to frame efficient rules for the safeguarding of the southern fly areas from infection. A period of quarantine, during which the native may be kept under observation, seems to be the only measure, but it is doubtful if this would be practicable owing to the expense entailed. Moreover, such a scheme would be difficult to enforce, though employers of labour might be compelled to sign on only such natives as are in possession of a quarantine certificate.

The gland-palpation method of examining natives does not seem to be applicable, nor could the examination of a single slide be regarded as reliable, even if it were possible to use the microscope in all subjects.

Even should such quarantine measures not be possible, no labour recruited in Rhodesia or from Nyasaland should be permitted to travel by any route which passes through *morsitans* areas. The length of the journey itself will weed out most if not all natives infected with trypanosomiasis, and if they had no chance of infecting fly on the road little harm will result.

In administering such a scheme of partial depopulation as is outlined above, it will be necessary to have some means of finding cases, as during the clearing and planting of the fly belt some natives will undoubtedly become infected. The system of patrols instituted by the writer in the infected area of the Dowa district, will be found to be efficient and cheap. One medical officer should then be sufficient for each district, exclusive of those in charge of segregation camps.

It is of the utmost importance that prophylactic measures should be carried out in all *morsitans* areas, even though no cases have been found. The expense entailed is not great; the concentration of villages is of great assistance in administration, and the planting of cotton and other products will be a great step in the development of the country.

Dr. G. C. Low, in opening the discussion, said: I am sure the Society is very grateful to Dr. Sanderson for the interesting paper he has read to us to-night. As many other speakers will wish to join in the discussion on the morphology of the parasite, on the prophylaxis, and on other points, I shall limit myself to briefly discuss some of the symptoms of the Nyasaland form of the disease. As regards the duration of the disease, Dr. Sanderson states that its course is more rapid than is usual in sleeping sickness, and quotes a case being dead in less than four months. Amongst our cases in Uganda in the early days of the epidemic in that country (1902) such rapid cases were the usual thing, and from this it is clear that when the disease invades a new area the early cases will be of a virulent type. Such, to my mind, is the explanation of the acute cases now being seen in Nyasaland. Headaches and pains in the chest were also common in the Uganda cases, and the usually supposed picture of sleeping sickness—patient sleeping all day long, and only being awakened with difficulty—was quite as much absent as in the cases described by Dr. Sanderson.

Castellani and I specially noted this fact in our report to the Royal Society, and pointed out that the term lethargy much better described the condition than sleep. Epileptiform seizures were by no means rare, and as these occurred in the pre-atoxyl days this at once disposes of Dr. Sanderson's suggestion that this drug might have played a part in their production. In uncomplicated cases of human trypanosomiasis (*e.g.*, no malaria) the spleen is enlarged, this being also common in rats experimentally inoculated with *T. brucei*.

I have already criticised the gland palpation method, so need not enter into details again here; though undoubtedly of use, it often fails. As regards Dr. Sanderson's remarks on the blood, a marked leucocytosis certainly does not occur in most of the cases. The leucocytes in trypanosomiasis are usually about the normal or a little below it (7,000 or under). Just before death a terminal polymorphonuclear leucocytosis is quite frequently met with, and coincidently with that there is generally a fall of the temperature to subnormal. Differentially it is true there is some increase in the large mononuclears, and that quite apart from any malarial infection. It will thus be seen that so far as clinical signs go, the Uganda and Nyasaland cases resemble each other very closely, the great virulence of the latter being due no doubt to the invasion of new

soil just as I have said occurred in Uganda in the early days. Of course it is very unfortunate that so few autopsies have been made on the Nyasaland cases. Careful researches into the pathological anatomy might lead to the detection of differences between those and the Congo and Uganda types of the disease. Though the trypanosomes are different in some respects, there is no reason of course why they should not cause a somewhat similar type of disease. Further studies are however required to clear up many of these points, and I hope Dr. SANDERSON will have the chance of doing this on his return to Nyasaland.

Dr. BAGSHAWE: I should like to congratulate Dr. SANDERSON on the excellent paper he has given us. I have no first hand knowledge of Nyasaland, so that I would just make one or two remarks about his scheme of prevention. With regard to *G. morsitans*. I am not sure it is correct to say that this species of tsetse fly avoids water. We all know that it is found very far from water, but I am not sure it is correct to say that it avoids water. It has been found on the bank of the Luangwa, in Rhodesia, and more than once on the banks of rivers in German East Africa. I found it myself on the banks of the Nile, but that is rather a long distance away.

Then Dr. SANDERSON says that this fly does not return to land which is fallow. I do not know anything about that, but I remembered that Sir ALFRED SHARPE, who has had a large experience of Nyasaland, made some remarks on that point, and I looked up the passage. He writes: "I have known cases where villages have been abandoned, and after a time as the natural bush has grown up, the flies have reappeared in places where the food plantations formerly were." That, I think, as well as the question of water, affects the scheme of prevention.

Another point with regard to gland palpation. Dr. MAY says that in Rhodesia, where the form of the disease is doubtless the same, he still sticks to gland palpation as being the only reliable way of examining natives. I do not know if the difference between the respective views is due to the smallness of the numbers of cases diagnosed by each. Possibly, had Dr. SANDERSON seen a larger number of patients, he might have got better results with gland palpation. Similarly, if Dr. MAY had seen a larger number of cases, he might have modified his views in the direction of Dr. SANDERSON'S. In each case the numbers are not very large.

Professor E. A. MINCHIN : I am afraid I have not very much to say. So far as one can see, *Trypanosoma rhodesiense* appears to be a newly-arisen species or strain. It was not known until recently, and there seem to me to be two possibilities of its origin ; one, that it is a strain of *T. gambiense*, which has become adapted to *Glossina morsitans* as its carrier, or that it is a strain of *T. brucei*, which has adopted human beings as its host. I have read most of the recent papers appearing on that question more or less thoroughly, and though I would not like to pronounce a definite opinion as to which of these two alternatives is the true one, it seems to me on the whole, more likely that it is a strain of *T. gambiense*, which has adapted itself to new conditions. As regards the supposition that it is a newly-arisen species, I think the extreme virulence which has been mentioned is also a point in favour of its being so. I gathered from Dr. Low that when *T. gambiense* first appeared in Uganda it was equally virulent, and this appears to be a feature of parasites which are new to their hosts. I do not know if these points have any value from a medical point of view, but they interest me as a naturalist.

The PRESIDENT : I should like to thank Dr. SANDERSON in the name of the Society for his interesting communication. I think it illustrates one of the great advantages of our Society. Many of us are greatly interested in sleeping sickness, from one or another point of view, but we have to depend for our knowledge chiefly on what we read and upon laboratory experiments, but here we have the opportunity of discussing the subject with a man who has been in the heart of it, who has studied the disease on the spot, and who has given us suggestions for prophylaxis, founded on his own observations, which appear to me of considerable practical value. It is only in a Society such as this we can get opportunities of this nature, and it is a great asset to us.

In my own laboratory I have both *rhodesiense* and *gambiense* strains but, as far as my experience goes, I cannot make out any marked distinction morphologically between them. There certainly appears, as has been pointed out, a higher degree of virulence in this new strain, and apparently a larger number of parasites are present in the blood of rats. This corresponds to what has been found in man in Rhodesia, where, in very acute cases, great numbers of trypanosomes appear in the peripheral blood.

The experiments which have been done, chiefly in Paris, on cross-immunisation of animals with these two strains, as I read them, do not appear conclusive, and I think we cannot, at present, say more than that they are closely allied.

As to the diagnostic value of glandular enlargement, of which Dr. SANDERSON spoke, it is very interesting to hear of his practical experience which confirms other views as to the unreliable nature of this test.

There are many other very interesting and debatable points one might refer to, but we shall doubtless have more precise information ere long from Sir DAVID BRUCE and his colleagues in Nyasaland.

Dr. SANDERSON: There is one point which bears on the morphological side of the question more or less. That is, on looking at a map of Rhodesia in which the cases have been marked as they occurred, one notices that they follow the Trade routes. It was Mr. NEAVE who pointed this out to me. It is undoubtedly true that the cases which have been found in Rhodesia are on the road from Tanganyika, and this may possibly be used as an argument that the trypanosome may possibly belong to the *gambiense* group. It is an interesting point. The rapidity of the infection is of great interest on the question of how long the disease has been in Rhodesia and Nyasaland—how old it is. If, as Dr. LOW says, the disease had a similar virulence when it first came to Uganda, it is probably of recent introduction in Nyasaland. Dr. LOW was querying my phrase, "clinical picture of sleeping sickness." I did not mean to suggest that the patient is sound asleep, but simply that you do not get the picture of the man suddenly falling asleep in the course of a meal, in conversation, or anything of that sort. He is quite able to finish what he is concerned with at the moment, and then sinks back, not asleep, but rather in a state of exhaustion. It is difficult to put into words, but it is not a similar case. You would not call the trypanosomiasis of Nyasaland sleeping sickness from the character of the last stage as you would in Uganda. The sleeping is not sufficiently marked for one to take hold of it to give it that name. It is possible that as a disease goes on the last stage may become longer, and you may have a similar picture as in Uganda.

Respecting Dr. BAGSHAWE'S remarks with regard to *morsitans* and its

relation to water. I had in my mind when speaking of avoiding water, that it avoids lake shores and river banks in the sense that it does not require water. It does not remain in narrow belts as *palpalis* does in the immediate vicinity of water. Of course, in the *morsitans* belts we find a lot of water during the rains, and the fly is not at all less common where the water occurs, so that the actual presence of water has not very much to do with the prevalence of the fly. Perhaps I have rather given that idea in my paper, and I must correct it.

Dr. SANDWITH: I should like to ask Dr. SANDERSON whether he has had an opportunity of doing any lumbar punctures or whether it is inadvisable to submit patients to this diagnostic method. I gather from his paper that not only the final coma is seldom seen but also the penultimate nervous symptoms which we have all seen in Europeans, loss of memory, convulsions and other phenomena which we think, rightly or wrongly, go with the invasion of the cerebro-spinal system by the trypanosomes. I rather gather from his paper that he suggests the idea that the patients die as it were of toxemia, to use his word, before the penultimate or tertiary invasion of the brain and spinal cord.

In spite of our gratitude to Dr. SANDERSON for giving us his interesting paper, I think we go away to-night with rather a depressed feeling, seeing that we thought we were beginning to know something about human trypanosomiasis due to *G. palpalis*, and we began to imagine we knew something about the disease, until the new infection was reported from Rhodesia and Nyasaland. I fail to see how anyone can prevent natives passing through *G. morsitans* areas.

DR. SANDERSON: I had considerable difficulty in getting the natives to submit themselves for treatment. They objected to the hypodermic syringe greatly. In the camp we have to consider the natives' dread of segregation, so that one is reluctantly compelled to sacrifice a good deal of interesting work for the sake of finding the cases, and this, I believe, has been the experience in other places. With regard to *morsitans* areas, and getting the natives to avoid them, it would be possible in Nyasaland to send natives round by sea to the mines, and this would help to check the spread of the disease. At present the native finds his own way to the mines overland, and is sent back by the employer by sea.

The PRESIDENT: I had the privilege recently of hearing an interesting account from Dr. PRENTICE of his experience of the manner in which the distribution of the fly had varied from time to time in particular districts, in apparent association with the abundance or rarity of wild game. I should like to ask Dr. SANDERSON if he has made any personal observations in this direction?

Dr. SANDERSON: My experience with regard to *morsitans* is so recent that I have nothing personal to add touching its relation to game. It is a very vexed question in Nyasaland at the present.

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The following comments submitted by Dr. J. W. W. STEPHENS were received subsequent to the meeting. Dr. STEPHENS criticises the statement in the paper that "the trypanosome is morphologically indistinguishable from *T. gambiense*," and contends that this is not the case, for he states that the trypanosome can be distinguished with certainty by the position of the nucleus, and this criterion was used by KINGHORN-YORKE in their recent paper on the Rhodesian trypanosome, and is in fact the most ready simple means of distinguishing *T. rhodesiense* from *T. gambiense*. He considers that the author in his next paragraph practically concedes this point, as he admits that "it may be regarded as certain that the (Nyasaland) parasite is the same (as *T. rhodesiense*)."

Dr. SANDERSON replies that he did not include the character of the trypanosome in sub-inoculation under the term morphology, and he had not seen any of the posterior nuclear forms in the blood of patients.

# EGYPTIAN SPLENOMEGALY AND ITS SURGICAL TREATMENT.

By OWEN RICHARDS, F.R.C.S., M.Ch.,

*Surgeon to Kasr el Ainy Hospital and Professor of Clinical Medicine in the Egyptian Government School of Medicine,*

AND

HAROLD B. DAY, M.D., M.R.C.P.,

*Physician to Kasr el Ainy Hospital and Professor of Clinical Medicine in the Egyptian Government School of Medicine.*

## INTRODUCTION.

The operation of splenectomy has been extensively practised with varying results in many disorders in which anæmia has been associated with enlargement of the spleen. Its success has been definitely established in early cases of so-called splenic anæmia, a disorder characterised by enlargement of the spleen with a secondary anæmia and leucopenia.[1] In other cases, notably those complicated with hepatic cirrhosis (Banti's disease) and those proved to depend upon Leishmania infection, its value is as yet undetermined.

Here in Egypt there is a common disease which closely resembles, in its various stages, the disorders described elsewhere as splenic anæmia (of infants and adults), pseudo-leukæmia infantum, simple splenomegaly, and Banti's disease.

The clinical and pathological account of the disease has been written by one of us (H. B. D.), and the surgical by the other (O. R.), while we have collaborated in the conclusion. The account of the morbid anatomy is abstracted from a paper[2] by one of us and Professor Ferguson, who is at present engaged in investigating its causation.

## Part I.

### INCIDENCE.

Splenomegaly, associated with hepatic cirrhosis, is common in all parts of Upper and Lower Egypt. It is found in an easily recognisable form in no less than ten per cent. of autopsies performed on natives dying in the Government hospital at Cairo (Ferguson). A special

examination of 300 consecutive patients of all ages admitted to the surgical and ophthalmic sections of this hospital, shewed that twelve per cent. suffered from the disease in a chronic form. In the medical wards this proportion is largely increased, and in four per cent. of these medical in-patients ascites, resulting from hepatic cirrhosis, is the reason for admission.

Out of 100 infants under the age of four years brought to a medical clinic, 20 were found to have splenic enlargement, which in 7 reached a considerable grade, and was associated with marked anæmia. Examination of the blood in these cases shewed no sign of malaria.

### AGE.

The disease is common at all ages up to 30, but in infants and children is apt to run a severe course, while at a later age the chronic form, progressing to ascites, is the type almost exclusively encountered. The average age of infants attacked was 15 months; the youngest was only $2\frac{1}{2}$ months old. After infancy the disease is less common, but again appears more prevalent after the age of 8. It is possible that a slight attack in infancy may confer an immunity for some years, and it is probable that the chronic cases in adults represent the results of repeated mild attacks.

### SEX, RACE.

The poorer native classes are chiefly if not exclusively attacked; there is no distinction of sex. I have never seen a marked case in an upper class adult nor in a resident European. It is rare to obtain a history of house or family infection, since the disease is not recognised by patients unless it is so severe as to cause actual abdominal enlargement from splenomegaly or ascites.

Concomitant disorders are the rule rather than the exception. In infants this disease is generally associated with rickets, while in older patients bilharziasis is usually, and ankylostomiasis often, present.

### SYMPTOMS.

The essential features of the disease are the same at all ages, and there is no need to distinguish a special infantile form. In babies, however, it commonly takes a severer and more rapid course. There is irregular fever, wasting, and striking pallor. The spleen is enlarged and

firm, and may reach to the umbilicus in severe cases, while the liver is also enlarged but of normal consistency. Vomiting and diarrhœa are frequent complications, and in the last stages œdema, purpuric eruption, and broncho-pneumonia occur. As mentioned above, the disturbance of nutrition commonly induces rickets. An account of the blood changes is given later, and is comparable to that seen in adults. In some infants a pseudo-leukæmia ensues, in one such case the total number of white corpuscles was 17,500, and myelocytes (neutrophile and eosinophile) were present.

In older children and adults the commencement of the disease is usually indicated by fever lasting a few weeks or even months. The fever is generally intermittent and irregular, and is not lessened by the administration of quinine. Afterwards a swelling of the spleen may be actually noticed by the patient, or he may complain of more or less pain over the left side, causing discomfort after meals, and a dragging pain on exertion. In many cases, particularly mild ones, the onset of the disease is insidious, and may be masked by general weakness and anæmia due to severe ankylostoma or bilharzia infection. In a third group, a history of diarrhœa or dysentery is obtained, but this is the exception rather than the rule. On physical examination the spleen is found enlarged, firm, and often tender. The liver generally shows a slight enlargement, but is soft and difficult to feel, thus resembling a fatty organ.

With the further progress of the disease the general symptoms—anæmia, wasting, and occasional fever—become more apparent. Sudden rises of temperature to 101° or 102° for one to three days are seen in about a third of the patients; in the series of severe cases treated by splenectomy half shewed such transitory fever. The spleen and liver both enlarge steadily, and produce a characteristic expansion of the lower part of the thorax and upper part of the abdomen, by which this disease can generally be recognised on inspection. The costal angle is much widened, the recti generally separated above the umbilicus, and the thoracic viscera displaced upwards, so that the apex may be seen in the fourth space. The hard spleen is felt a variable distance below the ribs, often extending half-way to the umbilicus: the liver is uniformly enlarged, smooth, and firmer in consistence than normal. It may even be overlapped by the spleen when there is much enlargement of both viscera.

Fibrotic hardening and contraction mark the next stage. In mild cases the disease comes to a natural termination, leaving but slight traces of its passage: in others definite hepatic cirrhosis with a persistently enlarged spleen ensues, and may last indefinitely. Whenever the spleen is hard, although it may barely project beyond the costal margin, liver changes are always advanced.

Instead of running a mild course the disease may be subacute from the outset or shew marked exacerbations from time to time. In such patients the spleen becomes greatly enlarged, often reaching to the umbilicus or beyond, while the liver is always cirrhosed, being hard and nodular to the touch. Its size may vary considerably, and is difficult to determine with accuracy owing to the great widening of the costal angle. The general symptoms of wasting, debility and anæmia are pronounced, and pain due to perisplenitic or perihepatic adhesions is common. The patient often induces vomiting to relieve the great discomfort felt after a big meal.

It is from this type of patient that most of the cases for splenectomy have been selected; details of the course of the disease and the blood condition are given later in their case-histories.

The last stage is the development of ascites as a complication of the hepatic cirrhosis. This grave event is generally the cause of a patient's applying for hospital treatment, and is commonly the result of a fresh exacerbation of the disease, as is well illustrated by Case 11. With the onset of ascites the general signs become aggravated. The patient is always emaciated, and the bodily exhaustion and the effects of the abdominal distension upon the thoracic viscera are prone to lead to fatal complications. On examination the contracted nodular liver can generally be felt in the costal angle and the spleen recognised by "dipping." At this stage the spleen rarely shows great enlargement, and it may not be palpable even after tapping; it is often impossible to feel the liver. Occasionally ascites may appear at an earlier stage, before the hepatic fibrosis has caused much contraction of the liver or irregularity of its surface. The characteristic blood changes are best seen in such advanced cases, but the anæmia is never profound enough to cause death by itself. Hæmatemesis is always uncommon, but jaundice and coma from hepatic insufficiency are often seen at the close.

## BLOOD CHANGES.

The blood picture varies with the acuteness and duration of the disease, and is often modified by complicating disorders. At the onset, particularly in infants, there is distinct leucocytosis, due chiefly to an increase in the numbers of mononuclear and eosinophile cells. Later, when the fever has abated, this leucocytosis disappears, and is succeeded by leucopenia with relative lymphocytosis, which is most marked when hepatic cirrhosis supervenes. The red corpuscles shew a progressive diminution during the course of the disease, and in the last stages may be reduced to well under two millions per c.mm. In such cases the red corpuscles exhibit considerable variations in size, shape and staining properties, but nucleated forms are most rare. The hæmoglobin is reduced a little more in proportion, the colour index being about ·9.

The anæmia is generally intensified by ankylostoma or bilharzia infection. In particular a greater loss of hæmoglobin (lower colour index) is caused by such complications, whilst the differential count shews a further increase of the eosinophile and large mononuclear cells at the expense of the polynuclear. In the late stages of the disease the presence of complications such as bronchitis often causes some polynuclear leucocytosis and obscures the typical leucocytic changes.

Appended are some figures based on the averages of a number of cases :—

| | Infantile. | Onset (adult). | Chronic (splenomegaly). | Advanced (ascites). |
|---|---|---|---|---|
| Number of reds | 2,682,000 ... | 3,820,000 ... | 3,368,000 ... | 2,080,000 |
| Number of whites | 8,100 ... | 10,000 ... | 3,993 ... | 3,750 |
| **Differential.** | | | | |
| Polynuclear ... | 33 ... | 54 ... | 51·2... | 56 |
| Lymphocytes ... | 45·5... | 30 ... | 32 ... | 22 |
| Large mononucl.... | 17·5... | 10 ... | 10·3... | 18 |
| Eosinophiles ... | 4 ... | 6 ... | 6·5... | 4 |

## COMPLICATIONS.

In Egypt the most common complications are due to rickets in infants, and worm infections and pellagra in later life. In weakly patients with much abdominal distension, slight bronchitis is common, and owing to the deficient expansion of the bases of the lungs congestion

of the bases and a form of hypostatic pneumonia is common. This complication occurs in most patients after operation, and is a frequent source of anxiety, although no patient's life has been endangered by it. I have not observed the special massive collapse, following operation described by Dr. PASTEUR.[3]

Among rare complications of advanced cirrhosis may be mentioned fatal hæmatemesis, thrombosis of the portal vein and the supervention of hepatic carcinoma, as in the ordinary European forms.

### DURATION AND PROGNOSIS.

As mentioned above, the course of the disease is always protracted, especially in older children and adults. A woman, aged 25, admitted with ascites of five months' duration, stated that she had suffered from splenic enlargement "all her life."

Hospital statistics shew that there is a difference of three years between the average ages of patients admitted for splenomegaly (with cirrhosis) and those suffering from ascites.

The prognosis depends on the activity of the disease, and essentially on the state of the liver. In infants especially, the disease often runs a comparatively rapid course, although I believe many slight cases recover. A very large spleen means active disease, often associated with fever, and carries a bad prognosis at any age; death may occur from exhaustion or hepatic insufficiency in such cases without the appearance of ascites. In mild cases the disease may come to a natural cure, little damage being inflicted on the liver. In severer cases, so long as the liver is not contracted to less than its normal size, and the general wasting not extreme, a fatal termination is not to be feared in the immediate future. The anæmia is never severe enough to cause death, and fatal thrombosis and hæmatemesis are rare.

Ascites is always an unfavourable symptom, and if the fluid rapidly re-accumulates after tapping a fatal termination may be expected within six months of its onset. When there is not marked wasting, however, the ascites may disappear, at any rate for a time; one such patient remained free from fluid for twelve years before succumbing to a recurrence.

Any coincident disease, such as ankylostomiasis, bilharziasis, pellagra, or chronic diarrhœa, greatly intensifies the symptoms and makes the

prognosis correspondingly grave. In cases complicated by ankylostomiasis the anæmia is usually profound, and but slowly and partially benefited by expulsion of worms.

## MORBID ANATOMY.

A full description is given by Professor A. R. Ferguson in the article already mentioned[2], from which the following brief abstract has been made :—

*Spleen.*—The average weight in fatal cases was 450 gms., the highest being 1,450 gms. It is very firm in consistence, of a dark-brown red colour, exuding very little blood on pressure. The vessels are relatively small and the Malpighian bodies almost indistinguishable. Microscopically, apart from a general hyperplasis, little change is seen. The most interesting phenomenon is active phagocytosis on the part of the macrophages towards the red-blood corpuscles and leucocytes, which may explain the peculiar characters of the anæmia.

*Liver.*—Examination of the liver in the early enlarged stage shews the hepatic cells to be highly granular, swollen, with paler nuclei, and deeper staining nucleoli than normal. Isolated necrotic foci surrounded by collections of small mononuclear cells are met with, resembling those seen in typhoid fever. Later, the organ presents the picture of multilobular cirrhosis, and in most cases dying with ascites it is reduced in size, and often firmly fixed by perihepatic adhesions to the diaphragm. On section, interstitial changes are manifest, the liver lobules being broken up by bands of connective tissue containing many lymphocytes. There is a comparative absence of the increased duct formation common in other varieties of hepatic cirrhosis.

*Bone Marrow.*—Is always altered, that of the shaft of the femur being transformed to a red colour. The granular cells largely disappear, their place being taken by round hyaline cells the size of a large lymphocyte. Nucleated red corpuscles are by no means abundant, and evidences of nuclear activity in any of the types of narrow cells are rarely encountered.

No constant changes are met with in the other abdominal or in the thoracic viscera.

## DIAGNOSIS.

When fever is present, as in acute and subacute cases, and at the onset of the chronic variety, the disease has to be distinguished from other prolonged infections accompanied by splenic enlargement. The absence of septic or tubercular disease, and the resistance of the fever to quinine are the first points to determine. A full examination of the blood is always necessary to prove the absence of malaria, enteric and Malta fevers, while a total and differential leucocyte count gives valuable information.

The chronic form of the disease characterised by hepatic cirrhosis and enlargement of the spleen presents few difficulties in diagnosis in Egypt, since other forms of cirrhosis are very rare. The possible effects of alcohol may be at once discounted, from the general youth of the patients and the fact that intoxicating drink is forbidden by the Moslem religion. In cases of doubtful syphilis, a positive Wassermann reaction and favourable results of specific treatment will clear up the diagnosis. Bilharziasis may cause a hepatic cirrhosis with moderate enlargement of the spleen closely resembling kala-azar clinically, although it can easily be distinguished post-mortem by the peculiar periportal distribution of the fibrosis and the abundant ova. It is, however, a rare variety of cirrhosis (under one per cent. of cases), never causes great splenomegaly, and is always accompanied by marked visceral infection. The splenomegaly of leukæmia may be distinguished by the absence of hepatic cirrhosis and the different blood picture.

Two signs are of value in patients whose liver and spleen cannot be felt even after tapping, and serve to differentiate this disease from tubercular peritonitis with effusion. The first point is the wide expansion of the costal angle due to previous enlargement of the viscera, and the second is the marked reduction in the numbers of the red corpuscles and leucocytes, even when the patient does not look particularly anæmic.

## CAUSATION.

So far no cause for the disease has been demonstrated. Although it seems on general grounds probable that it is due to a chronic infection with some organism of the Leishmania type, it has not yet been possible to obtain any satisfactory evidence of this. Till the investigations which are now being carried on yield some positive and definite results it is useless to speculate on the subject.

### TREATMENT.

So far no drug has been discovered that has a specific effect on this disease. Many of my Egyptian patients have improved under hospital treatment, but it must be remembered that this chronic disease is often marked by periods of remission, or may come to a spontaneous arrest. Attention to complicating disorders such as ankylostomiasis and diarrhœa, careful feeding up, and the persevering use of iron and arsenic have often succeeded in improving the general condition of the patient, but no effect on the enlarged viscera has been seen. Among the remedies given without success may be mentioned quinine (by mouth), ipecacuanha, and organic preparation of arsenic, such as atoxyl, soamin, and lately, salvarsan. Particulars of three patients treated with Ehrlich's remedy are appended :—

CASE A. Boy of 15, history of fever two years ago; pain below ribs on both sides for last six months. No fever. Liver extended 7 cm. below the costal margin in the nipple line. Spleen projected 7 cm. below ribs.

On July 26th, 1911, ·25 gms. of salvarsan in a neutral suspension were injected intramuscularly. This caused little pain, but had no effect on the size of the viscera.

He was seen again in February, 1912. The disease had progressed slightly, the liver was of the same size, but the spleen now reached 13 cm. from the costal margin.

CASE B. Similar case in boy of 10. Fever of an irregular type was present. ·25 gms. of salvarsan were injected in the same way. No effect on the fever nor on the size of the viscera were seen. Unfortunately the boy cannot now be traced.

CASE C - Male, aged 28. Ill five months with fever; has taken quinine without benefit. His daughter, aged 3, and many people in his village have been attacked by a similar fever and several have died. Fever was irregular and intermittent, rising to 38·5 at night, with occasional extra remission. The spleen extended 5 cm. below the costal margin and was firm; the liver reached to the level of the umbilicus in the nipple line, but was quite soft. The blood shewed no sign of malaria, and large doses of quinine were administered without benefit. The leucocytes numbered 10,000, of which 40 per cent. were mononuclear and 6 per cent. eosinophiles. The serum gave no agglutination with micrococcus melitensis and a tuberculin test was negative. The thoracic viscera were healthy.

Salvarsan ·5 gm. was given intravenously without effect on the fever.

## PART II.

For surgical purposes this disease falls into two groups.

(*A*) The cases in which cirrhosis of the liver and ascites are the chief features.

(*B*) The cases in which enormous enlargement of the spleen is the most prominent symptom.

Of course all degrees occur between *A* and *B*, and we are ignorant of the causes which determine the occurrence of one rather than the other, but for surgical purposes the distinction is a practical one.

As regards class A nothing could be done to relieve the cirrhosis, but it seemed possible that some palliative operation to relieve the ascites might make the patients' lives more tolerable. Such operations may be divided into those which aim at short-circuiting the congested portal circulation, and those which aim at draining off the ascitic fluid into the tissues as it is formed. It may at once be said that neither have so far resulted in any lasting benefit.

I have notes of five cases treated by a modified TALMA-MORISON operation, with implantation of the omentum into either a subperitoneal or a subcutaneous pouch. Some shewed a temporary improvement, but none, as far as they were followed up, derived any permanent benefit from the operation.

Of the drainage methods one or two cases were treated with silk threads draining into the tissues of the iliac fossa without result.

A more promising method, which was tried in two cases, is the insertion of a glass button with a perforated stem in the wall of the abdomen—a method originated and described by PATERSON.[9]

One case drained well at starting, and then refilled and required tapping at the usual intervals. The other made an apparently complete recovery, and was discharged free from ascites a month or two later. Unfortunately for our hopes he came back about six months later in his original condition, the button was still draining into the area immediately over it, but there was no general absorption, or at any rate not enough to make much difference. This method, however, is so simple, safe and rational that it deserves a more extended trial.

As regards class B, there seemed a reasonable chance that removal of the spleen would get rid of the main source of the disease. At any rate the spleen itself, by its presence in the abdomen, and by the adhesions which it forms to other organs, is the most obvious cause of the patients' sufferings. Removal of the spleen was accordingly attempted in thirteen cases, and carried out in eleven, of all of which notes are given.

## ILLUSTRATIONS.

*Case I.*—This was the first case in which splenectomy was attempted. The operation was stopped owing to heart failure. She went out unrelieved, and died at home six months later.

The dark outline shows the edge of the spleen. The white scars on the abdomen are due to the actual cautery applied at home: they are very common in Egyptian patients, and are useful for diagnosis, as they are good evidence of chronic pain in the situation in which they are found.

Note the widening of the costal angle. The whole distension of the abdomen is due to the spleen, no ascites is present.

*Case IV.*—The borders of the spleen, liver and ribs are marked.

The spleen was removed and the patient developed an acute bronchitis, from which she made a good recovery. She came up for inspection eight months later in good health.

*Case VII.*—This patient died three days after operation. He had advanced cirrhosis and much ascites. Over seven litres of fluid were withdrawn from his abdomen on admission. He is a good instance of the kind of advanced case that should not be operated on.

*Case VIII.*—This patient died of acute dilation of the stomach. He is a case of moderate severity, and on those grounds suitable for operation, but his general condition was poor.

*Case X.*—The spleen and liver are shewn, but not the ribs. This patient had a history of seven years' gradual enlargement of the spleen, and came in with fresh cautery marks. After the operation he developed acute bronchitis, but made a good recovery, and left the hospital in good condition.

*Case XI.*—Liver, spleen, and ribs shewn. This was an advanced case with jaundice and ascites, but after two months' stay in hospital he was so much better that operation was done. The spleen weighed a little over six pounds, the boy's weight being under seven stone.

After the operation he had fairly severe pleuro-pneumonia, from which he recovered. At the end of a fortnight he was transferred back to the medical side, but a few days later developed thrombosis of his portal system from which he died.

This case shews that enormous enlargement of the spleen does not make operation and recovery impossible, but that the danger lies in the cirrhosis of the liver.

## CASE I.

### ATTEMPTED SPLENECTOMY, HEART FAILURE, MASSAGE OF HEART, CLOSURE, RECOVERY.

This patient is a girl of 15. Two years ago she had an attack of fever and diarrhœa, lasting a month. During this illness the abdomen gradually enlarged, and it went on increasing in size until it assumed its present condition. Almost the whole of the abdomen is occupied by the spleen (see illustration). A cirrhotic liver is felt in the costal angle, which is much widened. There are numerous cautery marks on the abdomen. She has a poor appetite, but there are no other symptoms, no œdema of the legs, dyspnœa, nor palpitation. The pulse is regular, the apex beat in the V space, and the heart sounds normal.

An examination of the blood shews

| | |
|---|---|
| Red cells ... ... | 3,264,000 |
| White cells ... ... | 2,060 |

and a differential count gives

| | |
|---|---|
| Polynuclears ... ... | 34 per cent. |
| Small lymphocytes ... | 54 „ |
| Large „ ... | 3 „ |
| Transitional ... ... | 3 „ |
| Eosinophiles ... ... | 6 „ |

She was admitted under Dr. DAY on July 31st, 1910, and received various forms of treatment, including exposure to X-rays. On August 17th she was transferred to Mr. RICHARDS' section, and operation was performed on August 22nd.

*Operation.*—Under chloroform a long vertical incision was made through the abdominal wall two inches to the left of the middle line. The spleen was rotated outwards, and the pedicle brought well into view. A large vein going to the lower pole of the spleen was divided between ligatures. At this moment the heart stopped beating, and the patient stopped breathing. After the usual methods had been tried, a hand was passed up to the under surface of the diaphragm and the heart forcibly squeezed. It at once began to beat again, at first tumultuously, then steadily. No further attempt was made to remove the spleen, since it was felt that the displacement of that large mass was the probable cause of the stoppage of the heart, and that if the operation was once really entered on it would be impossible to stop half-way. The spleen was accordingly replaced in its original position and the wound closed in layers.

The patient made a good recovery and was transferred to Dr. DAY'S section on September 17th and discharged in the same condition on September 21st.

Information has since been received that she died on March 6th, 1911, nearly six months after discharge.

## CASE II.

### SPLENECTOMY, FOLLOWED BY PNEUMONIA, WELL ELEVEN MONTHS LATER.

This patient is a boy aged 12, complaining of abdominal pain and a splenic tumour of three year's standing. The history is naturally incomplete.

There is great enlargement of the spleen and hardness and enlargement of the liver. No other symptoms of importance—no ascites.

He was admitted under Dr. DAY on January 28th, 1911, and received an injection of 1·00 grm. soamin, and a course of iron, etc. On March 3rd he was transferred to Mr. RICHARDS' section.

His blood, on February 14th, showed a total leucocyte count of 2,500

A differential count showed

| | | |
|---|---|---|
| Polymorphs ... | ... | 46 per cent. |
| Lymphocytes ... | ... | 37 ,, |
| Large Mononuclears | ... | 16 ,, |
| Eosinophiles ... | ... | 1 ,, |

*Operation.*—He was operated on on March 6th.

A long vertical incision was made splitting the left rectus, the spleen was brought out through the incision. There were a good many omental adhesions. The vessels were ligatured between forceps and a running suture was passed over the edge of the divided lieno-renal ligament. The lesser sac was left open. The liver was seen to be cirrhosed in large irregular patches. The wall was closed in layers.

The operation was a very easy one, the vessels large, clean, and well defined, and the adhesions not very vascular.

The time from start to finish was 35 minutes, and the blood lost, exclusive of that from the abdominal wall, was apparently about half an ounce.

The spleen as removed weighed 2,040 gms. (about 4½ lbs). On removal of the clips it discharged 860 gms. blood, the residue weighing 1,180 gms., so that the contained blood formed over 40 per cent. of the total.

After operation the boy seemed very well, but the next day his temperature rose to 38·5 degrees, and subsequently to 39·8 degrees, and he developed an acute lobar pneumonia on the right side, from which he made, in due course, a good recovery.

On March 20th his white corpuscles had risen to 12,500, presumably in consequence of the pneumonia.

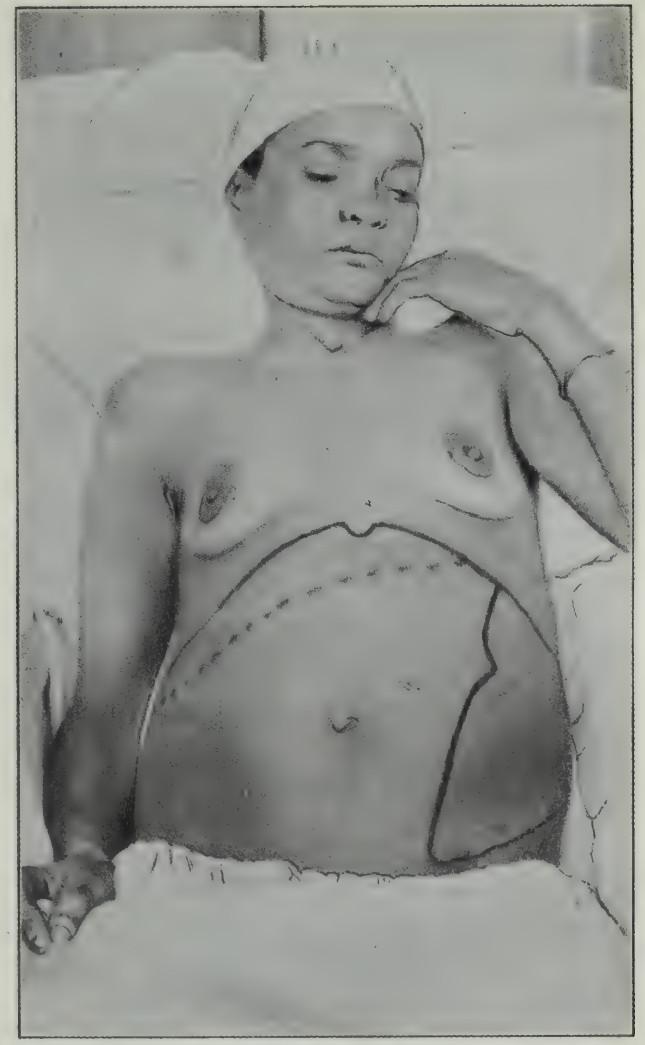
He was discharged in good condition on April 3rd, by which date his white blood corpuscles had sunk to 9,558. Red blood corpuscles 1,808,000.

On February 4th, 1912—eleven months after operation—he was sent up for inspection. The boy seemed very well. His scar was good and there was no hernia. There was still some separation of the recti, and whereas the median edge of the right rectus was strong and definite, that of the left rectus was softer and less marked. The left rectus, which had originally been stretched on the spleen, was weaker and had less tone, but there was less bulging than before the operation. The liver was 10 cm. deep in the nipple line, and extended for 5 cm. below the margin of the ribs. It felt smooth and soft. Hæmoglobin 68 per cent., red blood corpuscles 3,680,000, white blood corpuscles 8,311.

Differential count

| | | |
|---|---|---|
| Polynuclear ... | ... | 34·5 per cent. |
| Small lymphocytes | ... | 48 ,, |
| Large ,, | ... | 5 ,, |
| Transitional ... | ... | 3 ,, |
| Eosinophiles ... | ... | 9·5 ,, |

*Case I.*



*Case IV.*

## CASE III.

### SPLENECTOMY, RECOVERY, DEATH FROM CAUSE UNKNOWN FIVE MONTHS AFTER DISCHARGE.

This patient, a fellah aged 22, was admitted on March 25th, 1911, under Dr. DAY, complaining of abdominal pain on the left side for the last year. For the last three years he had also suffered from the usual signs of bilharzial infection and its resultant anæmia, viz: "piles," blood in the urine, headache, and weakness in the knees. His urine contained bilharzia eggs. No piles were present, the symptoms were presumably due to bilharziasis of the rectum. He was ill and badly nourished. There was separation of the recti, an enlarged spleen, and a hard liver reaching just below the costal margin. No ascites.

On March 27th his white blood corpuscles numbered 3·750. He was transferred to Mr RICHARDS' section on April 1st.

*Operation.*—April 4th. The incision, six inches long, lay over the outer border of the left rectus, which was pulled inwards after division of the anterior layer of its sheath. Subsequently a transverse incision outwards 1 in. below the costal margin had to be added to this.

The omentum lay over the spleen to its whole extent, and was adherent to both spleen and abdominal wall. The spleen was exposed through the overlying omentum, and gradually cleared, with ligature of the more vascular adhesions. The spleen was also adherent to the vault of the diaphragm, in fact it was adherent nearly all over. Finally it was freed and brought outside. The pedicle was ligatured piecemeal, the splenic vein was broad and gave some trouble, it was finally secured in intestinal clips and tied, as artery forceps were too small to control it. After removal there was a good deal of oozing from the small vessels in the adhesions, and a drainage tube was introduced into the cavity through a stab wound in the loin. The wound was closed in layers. A good deal of blood was lost, but mostly from the spleen, after ligature of its vessels. The operation was a troublesome and tedious one, and lasted an hour.

The spleen drained of blood weighed 1,130 gms. In Case II. removed bloodlessly, the contained blood weighed 10 per cent. of the total. If this proportion is constant this spleen should have weighed 1,880 gms. (over 4 lb.) when full.

After operation the patient had a rise of temperature to 39 degrees for a day or two, which then rapidly sank to normal. The tube was removed after two days. The wound healed well, there were no complications, and the patient was discharged on April 25th, three weeks after operation.

On January 29th, 1912, a letter was received in answer to enquiry to say that this patient had died five months after his arrival home. No information as to the cause of death was available. As will be seen from the condition on admission the patient suffered severely from bilharziasis.

## CASE IV.

### SPLENECTOMY, WELL 8 MONTHS LATER.

The patient, a woman 25 years old, was admitted under Dr. DAY on April 20th, 1911, complaining of pain and swelling in the left side, which had begun to appear immediately after a fall six months ago. Her general condition was fair. The spleen (see illustration) reached to an inch above the

ilium, the liver two or three finger breadths below the costal margin. No ascites. Some bronchitis present. White blood count 3,750. On May 6th she was transferred to Mr. RICHARDS' section.

*Operation.*—May 9th. A six inch incision was made vertically through the outer border of the left rectus. The liver was first inspected, and showed a fine cirrhosis. The spleen was moderately adherent to the omentum, the outer wall of the abdomen, and the diaphragm. Some adhesions were tied, others torn through, and the lower end of the spleen brought out through the wound. The vessels were then divided singly in succession between ligatures of thick silk. At this stage the weight of the spleen caused one of the veins to tear away near the hilum, but as the splenic artery and the proximal end of the vein had already been tied, the resultant hæmorrhage, alarming in appearance, was merely a loss of blood contained in the spleen.

When the pedicle had been dealt with the spleen was brought completely outside, and the remaining adhesions on the outer side, many of which contained fair sized vessels, were ligatured and divided. Several spleniculi, the size of nuts, were noticed and left behind in the hilum.

The wound was now dry and was closed in layers.

The weight of the spleen was 1,340 gms. after removal. The patient went back to bed with a good pulse.

She subsequently developed an acute bronchitis from which she made a good recovery.

On discharge, June 8th, her white blood count was 7,500, and her general condition excellent.

On January 6th, 1912, eight months after operation, she was brought up for inspection, very well and very grateful. The scar was good, no hernia.

The condition of the blood was then as follows: —

| | | |
|---|---|---|
| Hæmoglobin ... | ... | 68 per cent. |
| Red Corpuscles | ... | 3,568,000 |
| White „ | ... | 6,649 |
| Differential count:— | | |
| Polymorphs ... | ... | 26·3 per cent. |
| Small Lymphocytes | ... | 54·6 „ |
| Large mononuclear ... | } | 15 „ |
| Transitional ... | ... } | |
| Eosinophiles ... | ... | 4 „ |

## CASE V.

### SPLENECTOMY—WELL EIGHT MONTHS LATER.

The patient, a man of 35, fellah, began about three years ago to have attacks of fever, coming on in the afternoon, and passing off, with sweating, in the evening. These attacks lasted with intermissions about a year. During the succeeding years he noticed a gradually increasing hard swelling in the left side of his abdomen, which for the last year has caused him much pain and interfered with his getting about. He also had pain after food which he used to relieve by inducing vomiting by tickling his fauces. During the whole period of illness he was unable to work.

The enlarged spleen reaches the middle line of the abdomen and descends as far as the umbilicus. No enlargement of the liver reported—no ascites.

*Case VII.*

*Case VIII.*

At the operation however, the liver was found enlarged and cirrhosed.

The man's general condition was fair, and he had no symptoms other than those noted above. His leucocyte count was 6,560 on May 23rd.

He was admitted under Dr. DAY on May 16th, and transferred to Mr. RICHARDS' section on May 28th, 1911.

On May 30th, under chloroform, a long vertical incision was made and the left rectus displaced inwards. The spleen, a large one, lay mostly behind and above in the vault of the diaphragm. A number of adhesions to the omentum and elsewhere were torn through, and others ligatured and divided. When the spleen was sufficiently free it was delivered outside. The pedicle was well defined as a whole, but the individual vessels were rather obscured by fat and adhesions, so it was ligatured in two halves with thick silk. The wound was then found to be dry, what bleeding had occurred was chiefly from the spleen itself. The pulse and general condition were good. The liver was inspected and found to be uniformly cirrhosed and enlarged. The abdominal wall was sewn up in layers with silk, catgut and Michel's clips. Weight of spleen after removal 1,810 gms. (about 4 lbs.)

The patient made an uninterrupted recovery, and was discharged on June 20th, three weeks after operation. His white blood corpuscles were 6,565.

On January 24th, 1912, eight months after operation, he came up for inspection very fit and grateful. He says that before the operation he was unable to work properly for about five years, now he and a boy cultivate five acres with occasional help. This is full work for a man. His weight has advanced from 9 st. 7 lbs. to 10 st. 12 lbs. As the spleen weighed 4 lbs. this is a gain of 23 lbs. The scar is good. The liver extends to the V space in the nipple line, and reaches two inches below the costal margin, vertical height six inches, consistency softish.

Blood examination—

| | |
|---|---|
| Hæmoglobin ... ... | 70 per cent. |
| Red Corpuscles ... | 4,376,000 |
| White „ ... ... | 7,480 |

Differential count—

| | |
|---|---|
| Polynuclear ... ... | 52 per cent. |
| Lymphocytes ... ... | 32 „ |
| Mononuclear ... ... | 9·3 „ |
| Eosinophiles ... ... | 6·7 „ |

## CASE VI.

### SPLENECTOMY—WELL FIVE MONTHS LATER.

The patient is a man of 18, a fellah, who for the last four years has had swelling in the left loin. For the last fortnight he has been in bed with "fever." He is pale, anæmic, and has a poor appetite. The liver is hard, and extends three inches below the costal margin. The spleen extends from the seventh rib nearly to the ilium vertically, and from the vertebral column across the middle line horizontally.

The patient was admitted under Dr. DAY on July 12th, and treated with arsenic and fibrolysin. His white blood count was 2,800. On July 22nd he was transferred to Mr. RICHARDS' section, and operated on on July 25th by Dr. ALI BEY IBRAHIM.

A vertical incision about six inches long was made over the left rectus. The spleen was almost free from adhesions. The vessels were ligatured, and the only loss of blood occurred from the spleen itself. The wound was closed in layers. The weight of the spleen after the blood had escaped was 1,340 gms. (nearly 3 lbs.).

The patient made an uninterrupted recovery and was discharged on August 15th, three weeks after operation.

On December 15th, 1911, five months after operation, the patient was brought up for inspection. He has a firm scar, no hernia, his colour is better, and he is fatter. He is doing work, but not a full day. The liver is small and cirrhosed, not prolapsed. No ascites, the abdomen is hollow, and the ribs are still broadened out above it. The man is cheerful, grateful, and looks fit. White corpuscles 8,500.

## CASE VII.

### SPLENECTOMY—DEATH WITH CEREBRAL ŒDEMA IN THREE DAYS.

This patient was a fellah, aged 20, who several years ago had fever, which kept him in bed for over seven months. Later, about four years ago, he noticed a swelling in his left flank, which was about the size of an orange, and quite easily felt by the patient himself. This increased in size and later the rest of the abdomen began to get bigger, the original swelling remaining distinct. Before admission he had been laid up for a month on this account.

He was admitted to a Medical Ward on August 7th, 1911. On admission he was ill-nourished, rather pale and anæmic, with some dyspnœa due to the abdominal distension. There was much ascites, some jaundice, spleen hard and enlarged, liver not palpable (see illustration).

Three days after admission he was tapped, and 7,600 c.c. of fluid were withdrawn.

At this time his red blood corpuscles numbered 2,000,000, and his white 3,750.

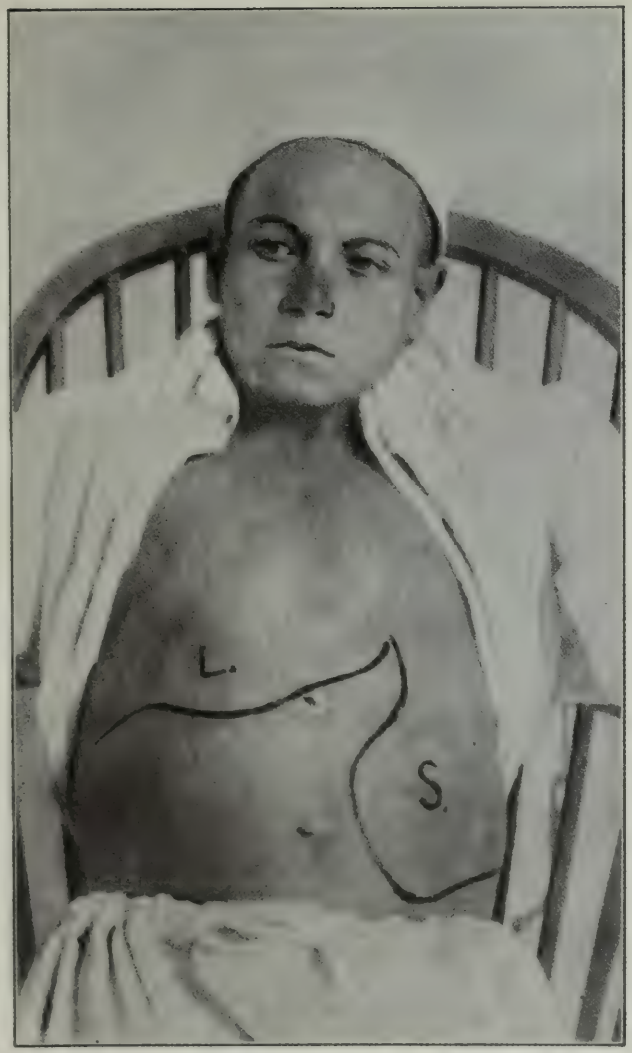
Differential count –

| | | |
|---|---|---|
| Polymorph ... | ... | 59 per cent. |
| Large Mononuclear ... | | 15 „ |
| Lymphocytes | ... | 22 „ |
| Eosinophiles | ... | 3·5 „ |
| Transitional | .. | 0·5 „ |

Nucleated red corpuscles (normoblasts) were also observed, but in very small numbers.

On September 5th he was transferred to Mr. RICHARDS' section, and on September 12th, under chloroform, a six inch incision was made splitting the left rectus. A few omental adhesions were tied off, and the spleen with difficulty turned out. The pedicle was thick and adherent, and contained much fat, the vessels were hard to isolate and were tied off in clumps with thick silk. There was a moderate amount of bleeding, both from the pedicle and the spleen, it looked more owing to dilution with ascitic fluid. The lieno-gastric omentum was tied off rather close to the stomach. Sewn up in layers without drainage. Time, 45 minutes.

On the following day the patient's condition was quite satisfactory. Temperature never above 37·5 degrees, but pulse rather rapid. On the third day he seemed very restless and had a rise of temperature to 39 degrees. His mental condition was very curious, he seemed lively enough,




*Case X.*

*Case XI.*

but when he was asked to put out his tongue he always left his mouth wide open and seemed unable to close it. He refused food, and was fed through a tube. He was apparently delirious, and answered at random. Finally he became comatose, and died in the night.

The post-mortem diagnosis was œdema of the brain. Heart, healthy—lungs, slight œdema—in the left pleura, 3 ozs. bloodstained fluid. Urine in bladder, alkaline –no albumen nor sugar. In the operation area there was nothing wrong, and there was about half-a-pint of bloodstained ascitic fluid in the peritoneal cavity. The stomach was dilated with gas and reached the umbilicus, the colon was also distended. The liver was cirrhosed. There was œdema of the brain as a whole, both lateral ventricles were full of fluid, and there was flattening of the sulci.

## CASE VIII.

### SPLENECTOMY –DEATH WITH DILATION OF THE STOMACH ON THE FIFTH DAY.

The patient was a boy of 14 who gave a definite history of three months fever more than a year ago. The fever used to occur at night and pass off in the morning. After this he had swelling of the whole body for about two months, and when this had passed off he noticed the swelling in the left flank which has increased ever since.

On admission he was weak, but with no symptoms other than the abdominal swelling, and consequent displacement of the heart. The spleen reached three inches across the middle line (see illustration), and there was some enlargement of the liver. A splenic puncture was done, and showed no evidence of malarial or any other infection. An examination of the blood was also negative. Leucocyte count 8,500.

He was admitted under Dr. DAY on October 22nd, and transferred to Mr. RICHARDS' section on November 4th.

On November 7th, an eight-inch incision was made in the left rectus from the costal margin downwards, splitting the rectus, and dividing the internal oblique and transversalis beneath it. The patient, who was straining, at once shot out an angle of the spleen and a coil of intestine, which were replaced. Some extravasation was noted round the splenic puncture. A few omental adhesions were tied off, and then the hand was passed round the spleen tearing through adhesions. These were fairly dense above, and unbreakable on the other side. When the spleen was fairly free, except on the outside, its anterior edge was delivered, and the pedicle tied off in three portions. There were no adhesions here, the vessels were easily divided between ligatures with no loss of blood.

The whole spleen after division of the pedicle was rotated outwards, various adhesions clamped and divided, and in particular a broad one lying on the outer side, under the tenth and eleventh ribs. This left, after removal of the clamp, a raw bleeding area about two inches by one inch which was with difficulty (owing to its position) partly closed with sutures. The wound was then closed in layers.

The spleen after removal weighed 1,250 gms.

After operation he had some vomiting, which continued intermittently for a day. Then he had a day free from vomiting, the abdomen movable and not distended. The pulse remained about 120 and the temperature, which was 39 degrees the night of the operation, gradually fell to normal.

On the 10th (the fourth day) he was found at midnight to be much distended with a bad pulse. He was said to have passed a motion in the morning. His only complaint was of pain in the right iliac fossa low down.

A stomach tube was passed, and released about 600 c.c. thin greenish fluid and a large amount of gas. This gave immediate relief. At 9 a.m on the 11th (fifth day) he was again rather full, so a stomach tube was passed, which let out first a quantity of light green fluid like that of the preceding night, and after it, not mixed with it, some thick brown fluid with a fæcal smell.

The previous result had suggested dilation of the stomach.

The fæcal fluid, however, had apparently been contained in the duodenum till removal of the green fluid released some kink and allowed it to enter the stomach, and this suggested some intestinal obstruction probably in the operation area. Accordingly the original wound was opened up. There was neither peritonitis nor hæmorrhage present. Small intestine much distended, it narrowed rather sharply four inches short of the cæcum, but there was no obstruction here or elsewhere. Large intestine contained nothing but gas. The splenic flexure seemed uninjured, the stomach was distended although it had been recently emptied.

The small intestine was incised and emptied with a long glass tube. This relieved the distension and the abdomen was then closed.

Death followed several hours later.

## CASE No. 7356.

### MOHAMMED SHERIF, ÆT. 16, SPLENECTOMY.

Report by DR. A. R. FERGUSON.

*Post-mortem Examination.*—There is no distension of the abdomen. The intestines are of normal calibre, but the stomach is distended with gas. The coils of intestine are slightly glued together by the smallest amount of fibrinous material, but the peritoneum is free from any evidences of infection. The site of the operation wound was critically scanned without finding any condition which could have given rise to intestinal obstruction.

The ligatures at the hilum of the spleen are tight, and no leakage of any kind has occurred. None of the ligatures, whether those of the hilum or of cord-like adhesions in the neighbourhood have implicated the colon in the slightest degree. The whole of the small intestine is heavy and contains a considerable quantity of fluid. No evidence of constriction or volvulus of any part of the intestine is discovered.

The appendix is firmly adherent in a deep sub-cæcal pouch, and the caput cæcum is also bound down more firmly than usual to the lateral parietes.

The stomach contains a quantity of greenish fluid estimated at 300 c.c. Its interior is normal, except for a degree of post-mortem digestion of the mucous membrane where it has lain in contact with the fluid.

The liver is enlarged (1,370 gms.). Its surface is smooth, but there is a very early cirrhosis of its substance, with advanced fatty change.

The condition of the heart, lungs, kidney, and other viscera calls for no special note.

## CASE IX.

### ATTEMPTED REMOVAL OF SPLEEN, RENDERED IMPOSSIBLE BY ADHESIONS.

The patient was a man of 50, admitted on June 20th, 1911. He gave a history of syphilis 20 years before. For the last 20 years he has suffered from attacks of fever and profuse sweating at irregular intervals. He cannot remember how long the lump in his left side has been present. He applied for relief on account of pain after food.

Leucocyte count was 7,500.

*Operation.*—August 3rd, 1911, by Dr. ALI BEY IBRAHIM.—Incision over the outer border of the rectus. The spleen was covered by omentum and firmly adherent to it, and to the parietal peritoneum. Every attempt to separate these adhesions was accompanied by severe hæmorrhage, and finally the operation had to be stopped without removal of the spleen. Abdominal wall satured in layers. Uncomplicated recovery, and discharge a fortnight later.

## CASE X.

The patient was a boy of 16, admitted under Dr. DAY, on December 2nd, 1911. The enlarged spleen has been present and gradually increasing in size for seven years. Two months ago he had a fortnight's fever, which was followed by a distinct increase in the size of the spleen. The liver extended 4 cm. below the costal margin in the nipple line, while the spleen measured 18·5 cm. from the ribs to its apex (see illustration). Ankylostoma ova were found in the stools, and the worms were got rid of by beta naphthol. After this treatment the blood count showed 4,410,000 red and 4,200 white corpuscles.

On admission he had a number of setons on the abdominal wall; these healed so slowly that he was not ready for operation till late in February. He was transferred to Mr. RICHARDS' section, and operated on by Dr. ALI BEY IBRAHIM on February 27th.

*Operation.*—Vertical incision through the left rectus. The omentum lay over the spleen and was attached to it by one adhesion which was divided. The spleen was free from adhesions on the diaphragmatic and parietal surfaces, it was easily brought out of the wound, and the whole of the hilum exposed. A bunch of vessels running to the lower pole was first divided, and then the vessels at the hilum were defined and divided between ligatures. The stomach wall was lightly adherent to the posterior part of the inner surfaces of the spleen, it was separated, and the adhesions divided between ligatures. Slight nonvascular adhesions united the spleen to the large intestine, the spleen was rotated further outwards, these and a few other adhesions broken down, and the spleen removed. Near the hilum a small accessory spleen was noticed and left.

The operation was bloodless except for the wound of the abdominal wall; every vessel was divided between ligatures. The abdominal wall was then sutured in layers. Weight of spleen 2,200 gms.

After operation the patient developed acute bronchitis, first on the left, later on both sides, with a temperature of 101—102 degrees for four or five days. He recovered from this about a week later. The wound healed by first intention. A slight recrudescence of fever occured during the next week, but patient was able to leave the hospital in good condition on March 16th.

The blood condition was then

| | |
|---|---|
| No. of reds ... | ... 5,104,000 |
| No. of whites ... | ... 7,480 |
| Hæmoglobin ... | ... 72 per cent |

Differential

| | |
|---|---|
| Polynuclear ... | ... 40·5 „ „ |
| Lymphocytes ... | ... 29·5 „ „ |
| Large mononuclear | ... 13 „ „ |
| Eosinophiles ... | ... 17 „ „ |

## CASE XI.

### SPLENOMEGALY WITH ASCITES AND JAUNDICE. SPLENECTOMY RECOVERY. DEATH 18 DAYS LATER FROM MESENTERIC THROMBOSIS.

Patient is a boy of 15; fellah.

He noticed nothing wrong until October, 1910, when he got pain in the left side, fever, and diarrhœa, which compelled him to take to his bed, where he stayed two months. During this time he noticed gradual swelling of the abdomen (see illustration).

He was admitted to hospital on November 14th; ascites was present and needed tapping at once; 3,600 c.c. were withdrawn. The spleen reached to within 1½ inches of the umbilicus; the liver was hard, not enlarged. The leucocytes numbered 4,060. He gradually improved, and the ascites disappeared; he was discharged December 19th, when it was noticed that his spleen had decreased 3 cm. in length.

He remained fairly well until December last year. He then had a similar attack of fever, which lasted a fortnight. The abdomen again enlarged. He was readmitted January 20th, 1912.

On admission, patient was distinctly jaundiced. Ascites was present, but the abdomen was not so distended as on the former occasion. He was tapped a week later and 6,000 c.c. withdrawn. This had to be repeated a week later, when only 2,700 c.c. escaped. He was treated with iron and arsenic, and fibrolysin injections (13 in all). The ascites and jaundice had disappeared by March 10th. The blood shewed steady improvement under treatment:—

| | January 29th. | March 4th. | March 18th. |
|---|---|---|---|
| No. of reds ... | 1,600,000 | 2,250,000 | 2,500,000 |
| No. of whites ... | 4,500 | 5,650 | 6,350 |
| Polynuclear ... | 54 | 59 | 61 |
| Mononuclear ... | 35 | 27 | 28·5 |
| Eosinophiles ... | 10 | 13 | 10 |
| Transitional ... | 1 | 1 | 1·5 |

He was then transferred to the surgical wards for operation. On March 19th, 1912, an incision eight inches long was made over the left rectus, the muscle was split, and the abdomen opened. The liver was cirrhosed and there was some ascites. The spleen lay more transversely across the abdomen than usual. This was pulled out, and vessels were found running to two definite secondary hila at the lower end; these were tied and divided. Numerous adhesions to omentum, stomach and diaphragm were broken down. Finally, the hilum was reached and found to be obscured by dense fat. Several vessels were isolated and divided singly between ligatures, finally the splenic artery and vein were tied in one ligature and divided.

The lesser sac was not opened. There was a little oozing from adhesions. The patient went back to bed with a good pulse, an hour and a half later he be became collapsed, but rallied very quickly. The operation lasted ¾-hour. The spleen weighed 2,780 gms.—a little over six pounds. The boy's weight was 6 st. 12 lbs.

Next day the temperature was up, and signs of pleurisy and some consolidation appeared at the right base. This cleared, but recurred on the left side. Apart from this he seemed fairly well and cheerful. He was transferred to the medical side about a fortnight later, and 17 days after operation developed an "acute abdomen." The abdomen was opened, and a quantity of blood-stained fluid issued, the small intestine was blue and solid from œdema. The wound was closed, and the patient died next day.

*Post-mortem Notes of Case XI.*—(Dr. FERGUSON).

Autopsy, April 6th, 1912, 18 days after operation.

Operation wound quite healed; tissues beneath healthy. Thin blood coloured fluid in peritoneum, about 500 c.c.

A large cavity full of fluid blood (over a litre) was found in the situation of the spleen. This is really a hæmatoma with a thin rind of blood clot not quite recent in appearance. The wall of the hæmatoma is very thin around the ligatures on splenic vessels, and it is probable that some leakage had occurred into the peritoneum from this sac. But the blood-stained fluid in the peritoneum had partly resulted from transudation through the walls of the thrombosed bowel. The whole small intestine except the duodenum and the last 10 inches of ileum was discoloured from thrombosis. Parts were almost black in colour.

The trunk of the portal vein is completely blocked by thrombus. A thin rind of fibrinous thrombus lines the vein, and is adherent to it. The interior of the thrombus is occupied by altered blood fluid. This thrombus is continued along the main branches of the vein in the liver, but becomes more recent in character as the smaller branches are reached. Downwards, the thrombus is continued into the trunks of the inferior mesenteric, pancreatic (which is much distended, and completely chocked with partially softened thrombus), and splenic.

The thrombus in the splenic vein is distinctly more recent than that in either of the others. It is a cylindrical greyish red thrombus, not at all adherent to the wall, except just near the ligature. Soft recent thrombi are also present in the gastro-epiploic veins.

Liver.—Is generally cirrhosed. The surface is much more coarsely granular than usual, more like syphilis. Capsule much thickened.

There are traces of acute fibrinous exudation over the bases of lungs; no consolidation.

Heart anæmic; right side dilated.

## CASE XII.

### SPLENECTOMY, ERYSIPELAS, RECOVERY.

The patient, a man of 28, noticed about four months ago a mass projecting below his left ribs which swung about when he walked "like the pendulum of a clock," so that he could only get about slowly. 1½ months ago he had an attack of fever, after which the spleen became harder. After a full meal he has a burning pain in the epigastrium which he relieves by inducing vomiting.

He was admitted under Dr. DAY on March 28th, 1912.

His spleen is large and hard, extends to within two inches of the umbilicus when he lies on his back, and reaches it when he lies on his right side. It extends two inches below the umbilicus, and moves freely on respiration. His liver is enlarged, in the nipple line it has a vertical depth of 12½ cm., and reaches 3½ cm. below the costal margin.

Blood count, March 30th :—

| | | |
|---|---|---|
| Red blood corpuscles | ... | 2,030,000 |
| White „ | ... | 8,750 |

Differential—

| | | |
|---|---|---|
| Polymorphonuclear | ... | 51·5 per cent. |
| Large lymphocytes | ... | 13 „ |
| Small „ | ... | 23·5 „ |
| Eosinophiles ... | ... | 9 „ |
| Transitional ... | ... | 4 „ |

Two erythroblasts were seen.

*Operation.*– On April 4th a vertical incision was made down the outer side of the left rectus. The spleen lay up under the vault of the diaphragm, and by the side of the spine, and was very difficult to get at. It was firmly adherent in these situations, the adhesions had to be broken down in the dark, and some of them were solid. All attempts to dislocate it from above failed. Finally the lower pole was pulled out, the vessels going to it divided between ligatures, and the mass gradually pulled downwards with division of adhesions till ultimately it could be pulled, levered, and squeezed out of the wound. The pedicle was then evident, the splenic artery pulsating strongly. This was divided, the rest of the pedicle tied off, and the spleen removed. Time 50 minutes.

This was the most difficult case of the series, owing to the high and deep position of the spleen, which necessitated much work in the dark. There was a good deal of oozing from the adhesions, none from the pedicle. Wound closed in layers. Weight of spleen 1,585 gms.

The patient's condition was good after the operation and next day.

A few days later he developed erysipelas at some distance from the wound, which spread and involved it. Later he had a subcutaneous abscess, and a mild form of pyæmia. Under treatment he improved, and two months after operation he is reported as much better, but still in hospital. There were no abdominal symptoms.

## CASE XIII.

Hospital No. 2546.

Boy of 7. Admitted April 20th, 1912. Has had a large abdomen from early childhood, following an attack of fever. No relief from a number of setons. Emaciated boy, weight 3 st. 8 lbs. Abdomen greatly distended with large spleen reaching two finger breadths to right of umbilicus, and to within four finger breadths of symphysis. From its apex to the costal margin it measures 26·5 cm. Liver enlarged, fairly soft in consistence. Trace of ascites. Boy looks anæmic. Ankylostoma ova found in stools.

Blood (April 24th)—

| | | | |
|---|---|---|---|
| Reds ... | ... | ... | 1,940,000 |
| Whites | ... | ... | 6,250 |

| | | |
|---|---|---|
| Polynuclears ... | ... | 56·5 per cent. |
| Lymphocytes ... | ... | 27 „ |
| Large Hyalines | ... | 13 „ |
| Transitional ... | ... | 1 „ |
| Eosinophiles ... | ... | 5·5 „ |

He was treated with iron and arsenic, and given cod liver oil and malt. The ankylostomes were expelled by beta naphthol and thymol. He put on 4½ lbs. weight.

Operation of splenectomy by Dr. ALI BEY IBRAHIM, May 21st, 1912. Long incision 20 cm. long, parallel to linea alba. A small amount of ascitic fluid escaped Adhesions cut. Splenic veins ligatured and divided. Spleen removed; it weighed 1·675 kilos. Next day temperature rose to 38·5. Then sank, rising in the evening to 37·7. Looks quite fit now, five days after operation: lungs clear.

(This boy has since left hospital in good condition).

## REMARKS.

The conditions met with in removal of these large spleens are different from those encountered in removal of a normal spleen for rupture, which form the basis of the text book descriptions.

For this reason I have ventured to go into some detail on the points which have struck me as important, not with any desire to lay down the law to surgeons of experience, but in order to give what help is possible to those who undertake such operations for the first time in outlying districts.

These operations are big, but easier than they look. They require a long incision, and care in dealing with the vessels, which are large and rather thin-walled. On the other hand, when the spleen is once turned out the pedicle becomes very accessible and easy to deal with, and the vessels can be tied deliberately and successively without much difficulty.

The incision varies with the size of the mass. It must be a vertical one of ample length to allow of the spleen being turned out through it without using force, and it must begin at the costal margin above, as so much of the organ lies up in the vault of the diaphragm. It is usually placed over the left rectus, but its relation to the muscle is variable—partly owing to the variation in size and position of the spleen, and partly because the recti are usually separated in the middle line, and the left rectus is so much stretched over the swelling that its position is quite inconstant.

The muscle is split in the direction of its fibres, or pulled inwards after division of its anterior sheath. In one case (Case III.) it was necessary

to supplement the vertical incision by one running horizontally outwards just below the costal margin, but this can usually be avoided, and must add to the weakness of the abdominal wall.

The disadvantage of the vertical incision described is that it destroys the nerve supply of the greater part of the rectus of that side. It is not possible to avoid this by going in the middle line, as this would not give free access to the outer side of the spleen, nor indeed to the pedicle, and since the incision must be a free one, the damage done is considerable.

At the same time, none of the four cases seen after some months showed any hernia, or any practical ill effects from the incision. In Case II. seen nearly a year later, where the incision was very long in proportion to the boy, there was distinct weakening of the inner part of the left rectus. The recti was separated, and when the fingers were inserted into the gap, the inner edge of the right rectus was felt hard and firm, that of the left rectus soft and less definite. On the other hand there was no hernia, or weakening of the abdominal wall as a whole, and it must be remembered that the left rectus had been for years stretched out in a thin sheet over the spleen.

In considering the possibility of hernia following the operation it must be borne in mind that the incision involves the upper part of the abdominal wall rather than the lower, that the pressure here is naturally less in the upright position, and that in these cases any tendency to hernia is rendered very unlikely owing to the relief of pressure brought about by the removal of the large spleen.

The difficulty of the operation, and the time it takes, depend chiefly on the presence or absence of adhesions, which vary very much in extent, and cannot be foreseen. There may be scarcely any, as in Case II., or the whole spleen may be so generally and densely adherent, as in Case IX., that removal is rendered quite impossible.

Adhesions occur between the surface of the spleen and the omentum, the outer wall of the abdomen, the stomach and colon, and the vault of the diaphragm, while the pedicle itself may become thickened and obscured. Sometimes they contain vessels of some size, but as a rule any bleeding which takes place on their division is due to laceration of the capsule of the congested spleen.

Most of the adhesions can be broken down with the fingers, and any firm bands clipped and dealt with later; but in some cases it is impossible

to do this. In Case III., where the omentum was spread out between the spleen and the abdominal wall, and adherent to both, the spleen had to be delivered through a hole in it.

In Case VIII. it was necessary to divide the pedicle as soon as the anterior edge of the spleen could be turned out, and to deal with the adhesions later. In this case there was a broad firm adhesion which left, after division, a raw oozing area up under the ribs, a place impossible to get at with any comfort.

When the adhesions have been freed, the spleen must be pulled completely or partially out of the wound and rotated outwards. This must be done gently, and helped by pulling down the outer edge of the wound. If force is used a great strain is thrown on the pedicle when the spleen slips out (as it sometimes does) with a jerk, and rupture of the vessels here would probably prove rapidly fatal. For the same reason an assistant must support the spleen while the hilum is being divided, so as to prevent its weight dragging on and possibly rupturing such vessels as remain undivided. The vessels are usually very obvious and clear. There is a constant large vein, or leash of veins, which run down to a recess, a sort of second hilum, at the lower part of the spleen, carrying with it a thin layer of peritoneum, which forms the lower free edge of the hilum. This is naturally the first vessel to be divided. It was the only vessel tied in Case I., and is probably the vessel alluded to in ARMSTRONG'S case.[8] After this the vessels at the hilum are tied off singly or in groups, first those in the lieno-gastric layer, and then the splenic artery and vein in the deeper layer.

The most convenient way is to separate each vessel cleanly for a short distance, pass two ligatures under it, tie one of these close to the spleen, and the other about an inch further in. Then divide the intervening vessel near the outer ligature. Artery forceps are very much in the way, and if the vessels are divided before they are tied they may retract away (as noted by BURGHARD)[1], and become rather hard to tie neatly afterwards.

There is in most cases no difficulty in isolating the vessels as the intervening tissue is loose and either transparent or loaded with a little soft fat, so that it can be stripped away bluntly with closed dissecting forceps.

If the whole pedicle is dealt with methodically in this way the resultant stump is a long line instead of a bunch, the ligatures are more

secure, and there is no stump left requiring absorption. Whether the lesser sac is opened or not depends on the state of the individual pedicle, its length, and its adhesions. If it is opened it can be closed with a running suture.

In two cases (Cases V., and VIII.) the vessels were so obscured by fat or adhesions that the pedicle had to be tied off bodily in two or three bundles, but this is much less satisfactory.

If the vessels have been properly ligatured the wound is dry, and can be closed without drainage. In Case III. where there has been a good deal of oozing, a drain was inserted through the loin for two days, but very little came from it, and it was probably unnecessary.

The closure of the wound is best done in layers, and the after treatment is that of any abdominal section.

These operations are attended by considerable mortality. JOHNSTON[4] gives a total mortality of 47·4 per cent. over 708 cases of splenectomy up to 1908. In the period 1900-1907 it was 18·5 per cent.

In 61 cases of Banti's disease, which clinically resembles the condition fairly closely, there were 12 deaths, a mortality of 19·5. For other records see TORRANCE[5].

This gives an apparent mortality of about one case in five, but this must be considerably below the real death-rate. This disease is uncommon both in Europe and America, and is rarely operated on. Few surgeons have reported more than one case in their own experience, and if a surgeon has only one case, and that unsuccessful, it needs a creditable amount of candour and public spirit to report it.

The chief cause of death, as might perhaps be expected, seems to be hæmorrhage and shock.

ARMSTRONG[8] gives a list of nine fatal cases out of a total of 32 (28 per cent.). Of these one died of puerperal septicæmia, one of bleeding from an œsophageal varix, and in two no cause is given. Of the remaining five all died within a few hours, presumably from shock and hæmorrhage. In three the cause is given as hæmorrhage, and in one of these it occurred on the table from this cause. At any rate hæmorrhage is the most important single cause.

The chief means of avoiding this have been indicated above. Hæmorrhage from adhesions may be troublesome, but is never likely to be serious, whereas bleeding from the pedicle, and particularly the

splenic vein, which may be as thick as a finger, is likely to be rapidly fatal.

In several of these cases free hæmorrhage has occurred from the splenic end of the vessels, which are necessarily tied very short. Provided that the artery has been already secured, this is not a loss to the patient, but merely to the spleen, and may be regarded with indifference, except so far as it obscures the field of operation. The spleen is an elastic bag full of blood; as was seen in Case II. the blood which it discharges is 40 per cent. of its total weight, so that in spleens of this size a quart of blood may be lost from them on the table without any loss to the patient, provided that the artery has been tied.

It seems advisable therefore to tie the artery as quickly as possible, and the central ends of the veins as long as possible, and not to waste time checking bleeding from the spleen, if by any accident it should occur.

In this series of cases hæmorrhage has not given rise to any difficulty, and there has been remarkably little shock. The fatal cases are due to other causes. One, Case III., which died from unknown causes five months after discharge from hospital, may be fairly neglected. Of the remaining three, one, Case VII., died in two days with cerebral symptoms, and the post-mortem examination showed no changes of any importance except œdema of the brain. For this death no adequate explanation is forthcoming; but it may fairly be assumed to have been due to the operation. The second (Case VIII.) is of greater interest. The clinical picture of this case was one of acute dilation of the stomach. Death occurred on the fifth day, there was no peritonitis, hæmorrhage or obstruction, but vomiting passing on to a passive dilation of the stomach with a thin green odourless fluid quite distinct from the intestinal contents, and a definite kinking at the pylorus secondary to this.

The third (Case XI.) was due to a portal thrombosis which came on seventeen days after operation. A similar complication has been described by SUMMERS.[6] In this case there was a large accumulation of blood and serum in the cavity left by removal of the spleen, and both this and the thrombosis were probably due to the same cause, namely, the advanced grade of cirrhosis of the liver. If there is sufficient back-pressure to cause ascites before operation, it is evident that raw surfaces left by the breaking down of extensive adhesions are likely to ooze indefinitely. And since thrombosis is known to be an occasional cause of

death in such cases without operation, it is always possible that it may follow operation. It appears from Dr. FERGUSON'S post-mortem report that thrombosis in this case had originated in the portal vein, and not spread by continuity from the clot in the ligatured splenic vein.

The lesson taught by these deaths is that cases which have progressed to the stage of ascites and jaundice should not be operated on. Of the three deaths occurring in hospital, one (Case VIII.) was due to acute dilation of the stomach such as may at times follow any abdominal operation. The other two (Cases VII. and XI.), were the only two cases in the series which had ascites and jaundice, and this points clearly to the conclusion that the grade to which the liver changes have progressed is the factor which really determines the risk of the operation. In Banti's disease a common symptom has apparently been hæmatemesis, and after operation, when the venous return from the stomach by the veins in the lienogastric ligament had been cut off, one case had a fatal hæmorrhage from an œsophageal varix. ROLLESTON in a discussion initiated by OSLER[7] points out the risk of gastro-intestinal hæmorrhage from this cause. None of the cases in this series shewed any such symptoms either before or after operation, but an advanced case with ascites in which Dr. ALY BEY IBRAHIM implanted a button in the manner described above developed a fatal hæmatemesis. In this case there was of course no question of interference with the venous return. It seems probable that this symptom is only likely to occur in those cases with advanced cirrhosis which are on other grounds unsuited for operation.

The only complications which occurred with any frequency were pneumonia, pleurisy and bronchitis. These were severe in Cases II., IV., X. and XI., nearly half the total number, and for reasons given in the first half of the paper, they may be expected to be fairly common in such cases.

To sum up the result of these operations :—

1. In two, splenectomy could not be carried out. They both left hospital as well as they entered it—one died six months later. This was Case I., with an enlargement of the spleen reaching to the right iliac fossa. Considering her condition, her death at this date can hardly be considered as hastened by the exploration.

2. Two cases died within a few days of operation, and their deaths may be assumed to be due to it.

3. One died eighteen days later from portal thrombosis.

4. One died five months later from causes unknown.

5. Four have been seen at periods from five to eight months after operation, and the operation seems to have cured them of their disease.

6. Three cases have only recently been operated on, but their general condition is better than before operation, and they have a reasonable expectation of a cure.

Further consideration of classes 1 and 4 may be omitted. In the fatal cases (VII., VIII. and XI.) one is forced to the conclusion that they were not fit for operation. Their deaths were not apparently due to any gross error, hæmorrhage, or excessive shock at the time of the operation, but seem rather to have been the result of a severe operation on patients whose general condition did not enable them to survive it. In Case VIII., beyond general weakness, there was nothing to indicate any special danger, but in Case VII. the small size of the liver, and the presence of ascites and jaundice, shewed that the function of the liver was already seriously impaired. The same may be said of Case XI., who had both ascites and jaundice. But whereas Case VII. was operated on without any special preparation about a fortnight after admission, Case XI. had had very careful preliminary treatment over a period of two months, and had markedly improved under it.

Probably the real position is that the risk of operation increases as the cirrhosis of the liver becomes more advanced, but that in cases on the border line so much improvement follows careful treatment and rest in hospital, that an unsuitable case may sometimes be converted into a suitable one by these means. The path of safety in operating on these cases would therefore seem to be in the direction of first selecting such patients as have no very advanced contraction of the liver, and secondly keeping them for some time in hospital, giving them a period of rest, securing the expulsion of ankylostoma worms if they are present, and using every means to get them into a fit condition to stand the operation.

The difficulty lies mainly in the proper selection of cases, for in suitable cases the shock is not great, and the fact that four patients passed successfully through attacks of pneumonia or bronchitis immediately after operation, shows that they possessed a considerable margin of safety.

The loss of the spleen has probably been already compensated for before the cases come to operation; the organ removed is very likely a functionless one.

The results in the four cases seen after some months' interval were remarkably good. In Case II. the red blood corpuscles has risen from 1,808,000 to 3,680,000, and the leucocyte count from 2,500 to 8,311. The boy was too young to be doing work, but when he was seen after a long railway journey and a good deal of waiting about, he seemed well and cheerful.

Case IV. was a woman. Since operation she followed her usual occupations, and she and her husband were very pleased with her condition. Her leucocytes has risen from 3,750 to 6,649.

Case V., who had been unable to work for years, is now doing full work in the fields. His leucocytes had increased from 6,560 to 7,480, and he had gained 23 pounds in weight.

Case VI. was doing work, but not a full day. He had grown fatter (according to his father's account), he was vigorous and cheerful, and his leucocytes had increased from 2,800 to 8,500.

It is too early to estimate the condition of cases X., XII. and XIII., but the first and last are clearly better for the operation, and have gone out. In view of these results it is clear that splenectomy offers to such patients a return to active life, and an improvement in condition amounting to a cure. Even if the disease itself is not entirely removed, the body is capable of making sufficiently good terms with what remains.

Against this must be set the immediate mortality—three deaths in eleven cases. Even if this rate of mortality is found to be constant, which, with a proper selection of cases is unlikely, it may still be contended that the results justify it, when we consider the invalid condition of the patients, and their limited expectation of life.

In conclusion, I should like to record my great obligation to my colleague, Dr. Aly Bey Ibrahim, who has kindly allowed me to include the notes of the cases VI., IX., X. and XIII., on which he operated himself, and who has given me invaluable help in all the others.

## CONCLUSIONS.

1. A chronic disease, marked by progressive enlargement of the spleen and cirrhosis of the liver, is common in Egypt. Its cause is as yet unknown, but its clinical course is quite characteristic.

2. Medical treatment improves the condition of the patients, but does not arrest the progress of the disease.

3. Cases in which the cirrhosis of the liver has advanced to the stage of ascites and jaundice are not fit subjects for radical surgical treatment.

4. Cases with moderate cirrhosis of the liver and great enlargement of the spleen can be restored to health by excision of the spleen.

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# NOTE ON THE TREATMENT OF BERI-BERI.

BY

DR. N. B. SURVEYOR.

I was very much interested in the discussion on Beri-beri, and as I happened to have a very severe case of the disease in my ward at the J. J. Hospital, I have been giving him an alcoholic extract of rice-waste dissolved in glycerine and normal saline, called locally "Konda," with marked benefit. The man was absolutely deprived of the power of moving his hands and feet—he had to be fed by the nurse, and had to lie helplessly on his back. Since starting this he is much better and is able to walk about with a pair of crutches. Before starting the "Konda Treatment" he was getting calcium glycerophosphate for more than two weeks without any improvement. On the supposition that it is the "Activator" which increases phosphoric metabolism, I have continued the calcium glycerophosphate, but the marked change was only produced after the third injection of the extract. I gave him only seven injections, and now he is taking it by mouth for the last month. Besides this case I have been treating two cases of osteo-malachia and two of rickets with the same treatment with considerable benefit. The osteo-malachic women whom I had under observation for several months, and who were bed-ridden, are now walking about without any support.

# REVIEWS.

## THE WELLCOME TROPICAL RESEARCH LABORATORIES.

The fourth report of the Wellcome Tropical Research Laboratories contains a fund of information to those interested in tropical countries, their inhabitants, and diseases; for these two volumes cover such a very wide range of subjects, that anyone taking the trouble to read them is bound to find some new and interesting information.

Dr. BALFOUR, as before, has contributed a very large part of the material, including articles on Spirochætosis, Kala-azar, Tropical Sanitation, and a most useful account of "The Fallacies and Puzzles of Blood Examinations," demonstrating clearly the care with which technical methods should be carried out in the tropics, and the discrimination required in reporting any apparently new forms.

Colonel MATHIAS has an article on "Sleeping Sickness" of great epidemological interest, showing the distribution of both *G. palpalis* and *G. morsitans* in the Bahr-el-Ghazel and Lado.

Captains ARCHIBALD, BOUSFIELD, FRY, and THOMSON have made valuable contributions on Trypanosomiasis and Kala-azar in the Sudan, giving important local details, much of which could only be obtained on the spot.

The great value of the floating laboratory is demonstrated, but we should bear in mind that the conditions under which our scientists work in the tropics are often very trying and difficult, also that the risks they run are considerable.

The continuous observations which are here set forth in these volumes, are evidences of the charm that tropical medicine has upon all those who take it up seriously.

In the second volume, which is devoted to "General Science," the contribution by Capt. R. G. ANDERSON, dealing among other things with the tribal customs of the Gour and Nyam Nyam peoples, is most interesting reading. Mr. BUTLER'S ornithological notes combine scientific and practical information of a high order.

These volumes are provided with colour plates and illustrations which are quite up to the high standard of the previous reports.

Dr. BALFOUR and his colleagues are to be congratulated on the work they have been able to accomplish, and the Sudan in having such an establishment to further its interests.

We would also congratulate Dr. A. BALFOUR on the honour of the C.M.G., which has been so lately conferred on him.

P. W. BASSETT-SMITH.

**Fourth report on Wellcome Tropical Research Laboratories, Vol. A, Medical. Vol. B, General Science. Edited by Dr. A. BALFOUR. London: Baillière, Tindall & Cox, 1911. Price: A 21/-, and B 18/- net.**

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## THE PARASITIC AMŒBÆ OF MAN.

By his previous studies on amœbic dysentery in various parts of the world, Captain CRAIG was well equipped to write a detailed life history of the causative organisms of that disorder, and their protozoal allies; and he has rendered a useful service to all students of tropical medicine in publishing in monograph form this systematic account of the amœbæ which are known to be parasitic in man.

Altogether, about fifteen species of human entamœbæ have been described; but although more or less definite symptoms have been associated with practically all of them, it is now generally believed that no more than two need be seriously regarded as actual pathogenic agents. Of these, *Entamœba histolytica* (SCHAUDINN) is of course by far the more important, but thanks largely to the work of Captain CRAIG himself in the Philippine Islands, of GREIG in India, and of DARLING and JAMES in Panama, it has recently become apparent that at least one other species is a frequent and widely diffused cause of amœbic dysentery in the tropics both of the Old and New Worlds. Owing to numerous obscurities of morphology, and especially to the difficulty of following the intricate processes of reproduction, the absolute identification of this species must still be regarded as uncertain; but it is more than probable that it is identical with or at least closely allied to *Entamœba tetragena*, which was originally described by VIERECK and HARTMANN as occurring in the dysentery of Central Africa. The pathogenicity of *Entamœba tropicalis* (LESAGE) of *E. Minuta* (ELMASSIAN) and of *E. Nipponica* (KOIDZANU) is still uncertain.

A fuller and more detailed historical statement of the researches which established amœbic dysentery as a specific disorder had already been published, but Captain CRAIG'S introductory chapter, which closely follows it, is a lucid and generally satisfactory account of the history and literature of the disease. The accuracy of his statement that SCHAUDINN'S classification of the intestinal amœbæ has been completely accepted by LUKE, BRAUN, HARTMANN, MINCHIN, STILES, WENYON, DOFLEIN and CALKINS is, however, open to question, for although it is true that SCHAUDINN'S arrangement of species is generally adopted, more than one of these observers still regard it as doubtful, and it is entirely repudiated by at least one of them. SCHAUDINN'S work is, rightly we think, now fully endorsed, and closely followed by Captain CRAIG; but in an impartial account of the researches connected with amœbic dysentery, the opinions which are held by a considerable number of careful investigators, and which have been so forcibly enunciated by MUSGRAVE and others, cannot be ignored, and even although he disagrees with their conclusions, Captain CRAIG'S review of the subject would have been improved had more prominent attention been directed to their work.

If somewhat too much emphasis is placed on the distribution of chromatin as a specific character, the account of the morphology of the parasitic amœbæ is clear and comprehensive. It must not be forgotten that the distribution of chromatin varies at different times in the same species, and that not infrequently it is disarranged in the nucleus or dispersed in the cytoplasm when the specimen is being fixed. The statement that a number of vacuoles of large size may be present in *E. histolytica* is not generally accepted. Lightly shaded areas of protoplasm which obviously contain granules floating in a digestive fluid are common enough; but true vacuoles, if they occur at all, are very rare.

Captain CRAIG'S description of the technique necessary for the demonstration and study of entamœbæ is terse, but full and accurate, and it will afford valuable assistance not only to clinicians but also to research workers. It may be noted that although almost all the processes for the demonstration of amœbæ were originally devised by European investigators, American modifications of these methods appear to be specially effective, and it is undoubtedly the case that better results have been attained in American laboratories than has been found

possible elsewhere. WRIGHT'S and HASTINGS' stains may be mentioned as specially useful for amœba work.

The author's scepticism as to the results of cultivation will be generally endorsed, and most observers will agree with his statement that "while it is not at all difficult to cultivate free-living forms, it is very doubtful, to say the least, if any of the amœbæ which have become parasitic can be cultivated by the methods at present in vogue." From the point of view of the differentiation of the various species of entamœbæ, his careful examinations of American soldiers in the tropics and elsewhere are also of the highest value, and his observations form a useful guide not only in determining the relative incidence of infection, but in estimating the importance of *E. histolytica* as a pathogenic agent. No more necessary statistical work than this has been accomplished in the pathology of amœbic dysentery.

The morphology and life history of the various species of entamœba are exhaustively and adequately described, and Captain CRAIG'S account of these organisms is obviously the outcome of a wide acquaintance with the literature of the subject, and of much detailed and painstaking observation. It is unfortunate that opportunity can seldom be given to a single worker to verify for himself all the statements which are made about a large number of widely diffused species, and naturally Captain CRAIG is more interesting when he is dealing with organisms which he has personally studied, but his descriptions accurately reproduce the accounts of the various authors. It only remains to add that his style is excellent, and that the book is clearly and lucidly written. The difficulty of compiling a biological memoir that is at once exhaustive and interesting will be readily appreciated, and in this respect it is sufficient to say that Captain CRAIG'S work compares more than favourably with numerous dry-as-dust volumes of natural history which have impeded rather than facilitated the study of tropical medicine. W. C. B.

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